

THE SEA SIDE



AND AQUARIUM

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THE PHOLAS BORING THROUGH THE ROCK.

DRAWN FROM NATURE.

Vide page 81.

THE
SEA-SIDE AND AQUARIUM;
OR,
ANECDOTE AND GOSSIP ON MARINE
ZOOLOGY.

BY
JOHN HARPER.

WITH ILLUSTRATIONS.

“Thy desire, which tends to know
The works of God, thereby to glorify
The great Workmaster, leads to no excess
That merits blame, but rather merits praise
The more it seems excess.”

MILTON.

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PAUL'S WORK.

“I have seen the cultivated man, craving for travel and for success in life, pent up in the drudgery of London work, and yet keeping his spirit calm, and perhaps his morals all the more righteous, by spending over his microscope evenings which would probably have gradually been wasted at the theatre. I have seen the young London beauty, amid all the excitement and temptation of luxury and flattery, with her heart pure and her mind occupied in a boudoir full of shells and fossils, flowers and sea-weeds, and keeping herself unspotted from the world by considering the lilies of the field how they grow ; and *therefore it is I hail with thankfulness every fresh book on natural history as a fresh boon to the young, a fresh help to those who have to educate them. . . . Books of natural history are finding their way more and more into drawing-rooms and school-rooms, and exciting greater thirst for knowledge, which, even twenty years ago, was considered superfluous for all but the professional student.*”—REV. C. KINGSLEY.

“ Goe, little book, thyselfe present
As childe whose parent is unkent;
And when thou art past jeopardie,
Come tell me what was said of me,
And I will send more after thee.”

SHEPHERD'S CALENDAR.

“ There is a great dele of good matter
Lost for lacke of telling.”

SPENSER.

P R E F A C E.

IN making another contribution to the rapidly accumulating literature of Marine Zoology, the author's object has been to present a Manual of the Science at once simple, comprehensive, and cheap. It may not, perhaps, be considered out of place in him to observe, that among the many admirable works with which he is acquainted, he has not met with any that seems to combine these advantages. Passing over such works as, from their purely scientific character, are obviously exceptional, the majority of treatises intended for general readers are either too expensive, or, if low priced, mere compilations.

To his Edinburgh readers, the author believes it will be a recommendation of his little work, the fact of his having been the first to illustrate, in a popular manner, Marine Zoology on the prolific shores of the Frith of Forth.

EDINBURGH, *March* 1858.

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THE
SEA-SIDE AND AQUARIUM.

CHAPTER I.

ACORN-BARNACLES.

“ Each shell, each crawling insect, holds a rank
Important in the place of Him who framed
This scale of beings—holds a rank which lost
Would break the chain, and leave behind a gap
Which Nature’s self would rue.”

STILLINGFLEET.

It was towards the close of a warm day, a few summers ago, and under circumstances somewhat ludicrous, that I formed my first acquaintance with the class of marine animals which I am now going to introduce to the reader. Having had the good fortune to discover at Joppa (a well-known village in the vicinity of Edinburgh), a district richly deserving exploration, I had been for several hours “collecting,” to use a technical phrase of zoologists, with the en-

thusiasm so natural to beginners. Nor was my zeal unrewarded. In spite of numerous slips ankle-deep in water, a fall that broke the bottle containing several Gobies—a mishap of which these little fish immediately availed themselves to regain their liberty—coming away from a pool and forgetting my chisel (a common occurrence, good reader, as you will find by experience), I managed to procure, among other prizes, several beautiful specimens of Anemones, or “quilled Dahlias,” as a certain author aptly names them. Partly from the good humour resulting from such success, and partly from the tempting appearance of the water, I determined to cool myself by a bath, before moving off townwards.

“Above me was the sky, beneath the sea,
I stood upon a point of shatter’d stone:
 The ocean spray
Quiver’d beneath my feet, the broad heaven shone
Around, and in my hair the winds did play,
Lingering, as they pursued their unimpeded way.”

Being almost as ignorant of swimming as of that department of natural history in which I had just been taking one of my earliest lessons, I determined to take advantage of the neighbourhood of a boat riding at anchor, a little distance from shore, for a practical lesson in natation. I had often heard it recommended as an excellent exercise for a novice in swimming to climb out of the water on a boat’s sides. Accordingly I had no sooner undressed than I waded to the skiff, which I found in about a depth of four

feet. But notwithstanding a variety of skilful manœuvres and ingenious contrivances, I was in a short time obliged to acknowledge that what I had looked upon as easy was very much the reverse. It is true that I more than once succeeded in raising my elbows and chest on the gunwale, but immediately the boat, as if resisting my intrusion, gave a lurch, and, in dread of her capsizing above me, I had to abandon my hold. In short, after a considerable expenditure of time and strength, I was obliged to give in, and make for the rocky cleft on which I had undressed. I had proceeded, however, only a little distance on my way back, when, no less to my surprise than dismay, I observed certain articles floating on the water, which I had no difficulty in recognising as my clothes! I had awkwardly omitted to notice the rapid advance of the tide; and now, half laughing, half angry, I had to seize my errant garments, and, more hastily than before, make for land. There I found that the rocks, which I had easily walked over half an hour before, had become intensely slippery, and seemed, to my imagination, as if mounted with knife-blades, cut into thousands of little pieces; nay, as I cautiously advanced, I felt as if each piece had been carefully “ground and set”—set edge uppermost. I had in consequence to creep very carefully along, being only able with great difficulty to keep my footing. But, at last succeeding in gaining a secure and sheltered spot, I immediately set about wringing my wet clothes, and then exposing them to the sun. While

so occupied (rather ruefully I must confess), I was greatly startled at observing some hitherto undetected peculiarity of my person. It was strangely tattooed with zebra-like stripes in many places—a phenomenon I may briefly explain to have resulted from my wrestling against the tarry sides of the boat. But although the effect of that contact involved an unpleasant amount of friction, it was greatly less annoying than the painful condition of my feet and toes. My soles were profusely bleeding, and presented an appearance extremely similar to the cross-hatched backgrounds of one of Mr Gilbert's wood engravings. Indeed, several weeks passed before "the cut" became worn down, though constant "impressions" were being daily made.

I introduce this little narrative in order to caution my young friends at the sea-side against Barnacles. Barnacles? you inquire. Yes; the knife blades that so unmercifully cut into my soles were the Acorn-Barnacles.

There are very few marine animals of which specimens are more easily obtained than the members of this family. Indeed, so profusely are they studded over rocks around our shores, that one would suppose a house painter had been with a white-wash brush, and splashed it vigorously over every boulder. Dip your hand in a pool, and seize upon a Crab (if you dare), a Limpet (if you can), a Mussel, or a Buckie, and the probability is, that whichever you lay hold of, has one or more Barnacles immoveably fixed to its back.

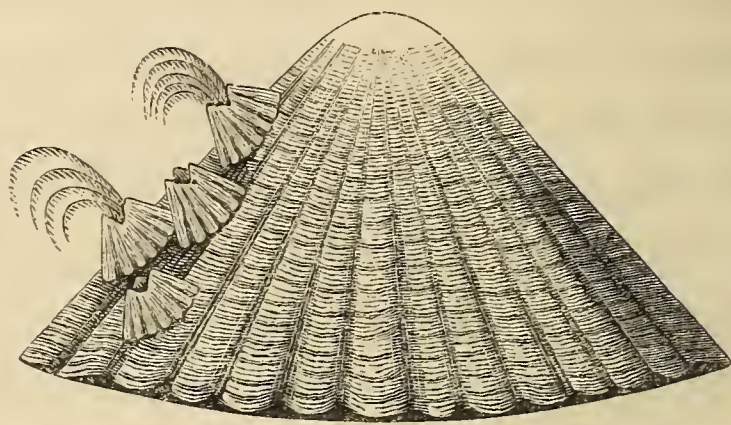
Let me suppose you are looking at my Aquarium. Here I shew you a piece of stone, covered over, you perceive, with white conical spots. The animals which I inform you are represented by the spots do not strike you as in any way remarkable, certainly not for beauty. But have patience for a moment. I have dropped the stone into the water. Let us look at it after a few minutes have elapsed with a hand-lens. Is not that a marvellous change? Were you prepared for such a beautiful sight? Each shell has opened, and from each aperture "a fairy-like hand is constantly thrust, grasping at some coveted object, and then closed and withdrawn."

But the object of this curious apparatus, however beautiful in itself, is of a decidedly utilitarian character. It is for the express purpose of ensnaring such minute animalcules as may be within reach, to "drag them down in the vicinity of the mouth, where, being seized by the jaws, they are crushed and prepared for digestion. No sense but that of touch is required for the success of this singular mode of fishing, and the delicacy with which the tentacles perceive the slightest contact of a foreign substance, shews that they are eminently sensible of tactile impressions." *

The following engraving represents four Barnacles attached to the shell of a Limpet. Two of them are "fishing," while the other two are in a passive state. Nearly the whole surface of the original Patella was

* Rymer Jones's "Animal Kingdom."

covered with Acorn shells, but these, before making the sketch, I removed, in order to give my readers a better idea of both molluscs.



COMMON LIMPET (*P. Vulgata*), with "Barnacles" attached.

An extraordinary fact in connexion with the little Barnacles remains to be mentioned. This is the transformation they undergo. In describing it, we may avail ourselves of the elegant account of Mr Gosse:—

"It" (the Barnacle) "begins life in a form exactly like that of a young Entomostraceous Crustacean (or Water-flea), with a broad carapace, a single eye, two pairs of antennæ, three pairs of jointed, branched, and well-bristled legs, and a forked tail.

"It casts off its skin twice, undergoing, especially at the second moult, a considerable change of figure; at the third moult it has assumed almost the form of a Cypris, or Cythere, being enclosed in a bivalve shell, in which the front of the head, with the antennæ, is greatly developed, equalling in bulk all the

rest of the body; the single eye has become two, which are very large, and attached to the outer arms of the bent processes, like the letters **U U**, which are seen within the thorax.

“In this stage, the little animal searches about for some suitable spot for permanent residence; a ship’s bottom, a piece of floating timber, the back of a whale or turtle, or the solid rock. When its selection is made, the two antennæ which project from the shell pour out a gelatinous gum or cement, which hardens, and firmly attaches them. *Henceforth the animal is a fixture, glued by the front of its head to its support!* Another moult now takes place; the bivalve shell is thrown off, with the great eyes and their **U**-like processes, and the little *cirriped* is seen in its true form.

“It is now in effect a Stomapod Crustacean, attached by its antennæ, the head greatly lengthened (in *Lepas*, &c.), the carapace composed of several pieces, the legs modified into *cirri*, and made to execute their grasping movements backwards, instead of forwards, and the whole abdomen obliterated, or reduced to an inconspicuous rudiment.”

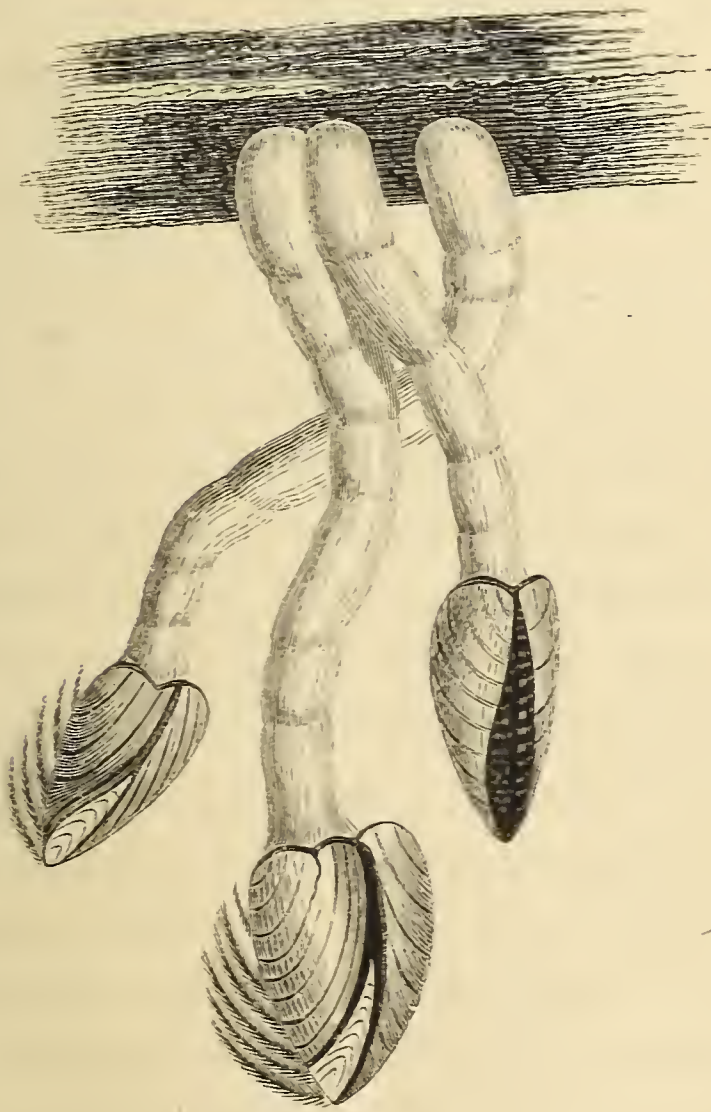
But Barnacles, notwithstanding their beauty, and their many curious peculiarities of structure, are unfortunately not very well suited for an Aquarium. So long as they are alive, they are harmless; but after death they become dangerous to the surviving occupants of the tank. Therefore, if you determine to introduce them, do not forget to keep a sharp look

out upon their state of health. So long as the "fairy hand" referred to continues to fan the water, all is safe; but whenever that movement ceases for any length of time, take your syringe and pour a stream of water over the whole colony of Barnacles. Should the commotion so excited fail in bringing them boldly to their doors, or if they venture only in a timid manner, lose no time in removing the piece of stone, or whatever else they may be fixed to. Unless this care be taken the tank will soon be tainted, and its more delicate inmates perish, from their incapacity of inhaling the noxious gas, caused by the decaying Barnacles.

The little Barnacles, of which we have been hitherto speaking, possess rather famous relations—the Ship-Barnacles (*Pentalasmis anatifera*), of whom many strange stories have been told, stories so strange that it may not be considered quite out of place here to refer to them. These will, at all events, possess some interest for younger readers.

The members of this family, instead of growing flat, like the Acorn-shells, upon rocks, &c., live upon stalks, as the case may be, pieces of driftwood, or the keels of ships. In the latter case, it has been noticed that their growth is so rapid, that in the course of a few months the planks of a vessel will be so closely studded with them as to impede its progress. "When ships thus covered arrive in our ports, the Barnacles are eagerly scraped off by men, who take them for sale as marine curiosities, or who make

their delicate white porcelain-like shells into some kinds of fancy shell-work. The Barnacles themselves are eaten on some coasts of Africa, where they are very abundant. The shell of this animal is at the end of a long fleshy stalk, generally of a purplish red, sometimes of a bright orange colour, and is of the form called multivalve, being composed of five pieces or



SHIP-BARNACLES, attached to a piece of Timber.

valves, two of them on each side of the animal, and a narrow piece down the back. It is a pretty shell,

clear and brittle, of a white colour, tinged with pale blue."*

In our previous cursory reference to the wonderful transformations undergone by the Barnacle tribe, the reader would understand that these assertions rest upon the evidence of modern naturalists.† Now, although many of these have devoted much study and patient labour to the subject, who can be so bold as to declare that, in a few years, others may not bring forward explanatory hypotheses of quite an opposite character? For seeing is not always believing, in matters connected with natural history, at least according to some statements we read of among old authors. Were it so, we should now believe that these same Barnacles were the young of the Solan Goose! a bird that haunts in vast numbers the Bass Rock, and other localities. Nay more, a common belief in different parts of Scotland, and over the West of England, was, that the shells grew upon certain trees, and, in progress of time, opened of themselves. Whereupon a certain animated substance contained within the shell dropped down, and according to the place where it fell it perished or fructified. By falling into water it grew to be a fowl, but by falling upon land the vital principle became extinct. The fowls which resulted from the more fortunate contingency, were called Barnacle Geese in Scotland, and Brant or Tree Geese in England. The error which this imagined transfor-

* Miss Pratt's "Things of the Sea-coast."

† See Appendix, Note 1.

mation was long ago proved to have been, appears to have arisen from the fact of Barnacles having been found in great abundance on the trunks and even branches of trees long submerged in the sea. It is not incurious, however, to hear what Hector Boece, in his "History of Scotland," says regarding the old belief, the correctness of which, according to his account,

"Was most notablie proued in the year of grace 1490, in sight of many people, beside the Castell of Pesligo, whither the bodie of a great trée was brought by the working of the sea. This trée being taken, it was carried to the lord of the soile, who soone after caused it to be slit in sunder with a saw; which being done, it is incredible to sée what a multitude of worms came out of their holes. Of these also some appeared as if they had beene but new shapen, diuers had head, foot, and wings, but no feathers, *the rest were formed into perfect foules*" (!)

After giving three other instances of a similar character, our author continues:—

"And also, within a few yéeres, in like sort, a ship named the 'Christopher,' after she had lien thrée yéeres at anchor in one of these Iles, was brought to Leith, where, bicause hir timber was found to be rotten, she was taken in sunder, and in hir kéele were found infinite holes, as if they had beene eaten with wormes or bored with a wimble, and each one of them filled with such creatures as I have said before."

Then comes the important part of this "veracious

historie," in which the writer receives ocular demonstration of the truth of his statement:—

“Heere (he says) if any man will alledge that the ‘Christopher’ was builded of such timber onelie as grew in these Iles, and that all roots and trees there growing are of such nature as, in their corruption, doo turne into these foules, I will disprooue his assertion by one notable example *shewed before mine eyes*. Maister Alexander Galloway, parson of Kinkell, was with vs in these Iles, and giving his mind with attentive dilligence to search out a full resolution with vs, of these obscure and hidden matters, it happened on a time that he took up a branch of alga, called in Scottish, Seatangle, which hanged full of muskle shells, from the root euen to the verie top. Being also desirous to see what was in them, he grew to be more astonished than before; for when *he opened one or two of them, he saw no fish, but a foule perfectlie shapen, fully answering to the capacitie of the shell (!)*

“Finally, knowing that I was very inquisitiue of these and like rare novelties, he came hastilie with the said hearbe and shewed it vnto me, who found no lesse by experience than I have before reported. By these and many other reasons and examples I cannot believe that these Claiks (or Barnacles, as I call them) are producted either by the qualities of the trées, or the roots thereof, but onelie by the nature of the sea, which is the verie cause and productrix of so manie wonderful creatures. Furthermore, bicause the rude and ignorant people saw oftentimes the

fruits that fell from trées which stood neuer in the sea, conuerted within short time into geese, they beléeued that these geese grew vpon trees, hanging by their nebs as apples and other fruit doe by their stalks, but their opinion is utterlie to be rejected. For so soone as these apples, or fruits, fall from the trée into the sea, they grow first to be worm-eaten, and in process of time to be converted into geese.”*

Nearly 200 years after the above strange narrative was written, we gather from the pages of Gerarde, how firmly it was believed even among the best informed of his day. This writer not only gravely confirms the old historian’s opinion, but is at great pains in giving various engravings, intended to represent the Barnacle Geese in the different stages of their development, from the shelly mollusc to the full-grown fowl. The latter are exhibited swimming about under the boughs of the trees from which they had fallen. “What our eies have seen, and our hands have touched, we shall declare,” is the authoritative deliverance of the learned Gerarde. He describes the process of transformation with minute accuracy, adding that “as the shells gape, the legs hang out,” and “that the birde growing bigger and bigger, the shells open more and more, till at length it all comes forth, and hangeth by the bill.” Thereafter it speedily attains maturity, and “falleth into the sea, where it gathereth feathers and groweth to a foule”(!)

The Romish clergy helped greatly to substantiate

* *Vide* Professor Fleming’s “History of the Bass Rock.”

this story, by giving out that the Barnacle Geese were not produced from flesh of any kind, and, therefore, they might be eaten as fish on all fast-days. Such an absurd belief, we might readily suppose, would not fail to afford no small amusement to philosophers and poets living in less credulous ages. It does not escape the keen eye of the author of "Hudibras." Du Bartas also alludes to the popular notion, and even introduces an additional theory, to the effect that the Barnacle sprung from a fungus:—

“ So slow Boötes underneath him sees
In th’ icy islands goslings hatch’d of trees,
Whose fruitful leaves, falling into the water,
Are turn’d, as known, to living fowls soon after;
So rotten planks of broken ships do change
To barnacles—O transformation strange!
'Twas first a green tree, then a broken hull,
Lately a mushroom, now a flying gull.”

CHAPTER II.

PERIWINKLES, WHELKS (*Purpura*, &c.).

“How tenderly Rousseau review’d
His periwinkles—mine are strew’d!
My rose blooms on—my gown!”

T. HOOD.

“Not lost the time in sea-side rambles spent—
Braced is the frame, and mental health is gain’d;
Knowledge is gain’d of Him who made the deep;
And blissful love acquired of Nature’s works,
Of which each questioned minim soothly says,
The plastic power that form’d us is divine.”

D. LANDSBOROUGH.

I SHALL never forget the pleasant surprise I experienced, shortly after arriving in Scotland, on discovering the richness of the shores of the Frith of Forth in Periwinkles (*Littorina littorea*). I had been walking one afternoon from Edinburgh to Portobello, by way of Arthur Seat and Duddingston Loch; a walk that for variety and picturesqueness of scenery, is, I believe, unsurpassed. On reaching the beach I strolled leisurely along—being at that time quite

ignorant of the wonders of the shore. Like Wordsworth's Peter Bell—

“A primrose by the river's brim,
A yellow primrose was to him,
And it was nothing more.”

So was the sea-side to me. But my indifference was soon exchanged for positive delight, upon discovering all of a sudden, that the rocks were profusely studded with a kind of shell-fish to which most Londoners, during early life at least, are extremely partial. Thousands of Periwinkles lay before my astonished eyes. Immediately fashioning my handkerchief into a bag, I set about filling it with the dainty mollusc, and having done so, set off rejoicing on my way homewards.

On arriving at my lodgings, I forthwith displayed my Periwinkles to my kind-hearted landlady, with a request that she should cook some of them for tea:—“Pen—Penniwinkles,” said she, smiling, “Is that what ye ca’ them? We Scotch folk aye ca’ them *Buckies*! But,” she gravely continued, “ye’re shurely nae ga’en to ate thae *Snails*?”

“Yes, indeed I am,” I replied. Whereupon my landlady observed—in a quaintly humorous style—shaking her head, and holding up her hand, as she moved to the door with the despised *Buckies*—“Weel, weel! ye English folk wud just eat onything ava!”

The good woman's expression of disgust not a little amused me, conveyed as it was in the broadest of Scotch. I found, upon inquiry, that her antipathy

to Periwinkles was very general over the country. I may be pardoned for observing that it seems to me rather an absurd prejudice. Everybody knows that hundreds of boat-loads of the *L. littorea* are sold during the year at Billingsgate, and that thousands of people make an honest livelihood by retailing them through the streets of the metropolis. To London children the cry of “Wink ! wink ! Pennywink’ !” is especially musical ; and whenever the welcome sound is heard, a rush is made to mamma for pins and a penny, to make a purchase.

The taste for these little univalves is by no means of modern date, nor was it at all times confined to the poor. Pliny has left on record the name of a certain epicurean, Lupinus Fulvius, who formed preserves for his Periwinkles ; and even went the length, with the view of making them larger and more tender, of inventing a special diet for them. This was a mixture of boiled wine, spelt meal, and other rich substances. It is further said, that so important did these animals become in a gastronomic point of view, and such was the care bestowed upon their breeding, that the shell of a single individual would contain “as much as eighty quadrantes,” or about eighteen quarts, imperial measurement, according to classical commentators. How greatly has the modern species degenerated ! This falling off need not, however, be a cause of regret, if the same unhappy effects were to attend the consumption of these animals in our time as was visible among the Romans. The

last-mentioned author declares, that by no article of food were the luxurious habits, which afterwards proved so fatal to his nation, so greatly enhanced as by the use of shell-fish. "Of all the elements that exist," he adds, "the sea is one that costs dearest to the belly." Nor will the classical reader fail to recall the powerful verses of Juvenal, to the same effect.

I may mention, that since I have had an Aquarium I have lost all desire to look upon Periwinkles as articles of food or luxury. I admire them more than ever, but it is on account of their form, and not for their flavour. Eugh!

Mr Sowerby, treating of the Buckie, pleasantly observes: *—

"The pleasures of a sea-side ramble are much increased by an intelligent observation of the various forms of animation that are met with—among which the Periwinkles are often prominent, not only for their numbers, but also for their activity. They dot and stud the slimy rocks with their turbinated shells, or creep through the tiny corallines, or slide among the overhanging fuci in search of food—

‘Part single, or with mate,
Graze the sea-weed, their pasture;
And through groves of coral stray.’

"Let us examine the nature of these interesting objects by taking an example;—here is one at rest. We see a rather solid-looking shell, of a dark colour, perhaps distinctly banded; at the base, on which it

* "Pop. Brit. Conchology," p. 143.

rests, it is rounded out; but at the apex, which is toward the eye, it is a little pointed—its surface is not quite smooth, but at a glance appears as if it were so. It is *L. littorea*. On cruelly disturbing its repose by turning the shell over, so as to see the aperture, we find that the latter has a flattish white columella, or inner edge, and that, instead of seeing at once the soft parts of the animal, we find it is shut by a horny plate, or *operculum*, which is spiral, but with very few rapidly increasing whorls; presently this plate begins to be raised, and then peeping cautiously between it and the outer lip of the aperture, the tawny animal protrudes his head, which is closely marked with black waved lines—the muzzle is rather short, broad, and straight in front—the pyramidical tentacles are ringed with the black lines—they are blunt-pointed at the apex, but thick at the base, where they have a very thick swelling, on which the bright little specks of eyes are placed. Throwing back the pointed hinder part of the whitish foot, which carries away the horny door with it, the Periwinkle lifts his heavy shell over his back, and crawling away, is soon out of sight.”

This is a graphic description of the Periwinkle as he is seen on the rocks, but our most interesting view of him is as an occupant of the Aquarium; there he is indeed always welcome and useful.

After your Aquarium has been established for a few weeks, you will observe a vegetative growth, consisting of minute spores of sea-weeds, collect upon the

sides of the tank, rendering it to a certain degree opaque. This is a healthy symptom of the vitality of its occupants, but, as it has the disadvantage of seriously obscuring your view of the interior, you will be desirous to remove it. That can easily be done by rubbing the surface of the tank with a bit of rag, twisted round the forefinger, or, better still, tied to a rod. There is a yet easier way of attaining the desired result, and that is, to introduce a number of Periwinkles and Limpets. These animals very soon give obvious tokens of how greatly pleased they are at being transferred to such an accessible range of tender pasturage. They eat away with a relish truly astonishing. It is indeed an interesting sight to notice a Buckie thus engaged. I have often sat for half an hour at a time, watching through a hand-lens the busy molluscous mower. Mr Gosse, describing the operation, says in his usual happy style, "When he" (the Periwinkle) "eats, he separates two little fleshy lips, and the glistening, glass-like tongue is seen, or rather the rounded extremity of a band of it, *rapidly running round, like an endless band in some piece of machinery, only that the tooth points as they run by remind one rather of a watch wheel*; for in an instant this appears, then the lips close again and presently re-open, and the tongue again performs its rasping. It is wonderful to see ;—perhaps" (adds this amiable author) "not more wonderful than any other of God's great works, never less great than when minutely great; but the action and the instrument, the perfect

way in which it works, and the effectiveness with which the vegetation is cleared away before it, all strike the mind as both wonderful and beautiful.”

I have classed the Limpet (*Patella vulgata*) with the Periwinkle, as being equally useful as a tank scavenger. He is not inferior in interest as an object of study, while as an ornament, no comparison can be instituted between the two. Indeed, few occupants of the Aquarium are more pleasant to look at than a Limpet, as he glides along, with a whole forest of weeds and frondlets growing on his back.

Our familiarity with this mollusc—it is one of the commonest on the sea-shore—is apt to make us imagine there is nothing wonderful or peculiar in his structure. A little acquaintance with zoology will, however, soon undeceive us. Indeed, almost every part of the construction of this animal is calculated to excite our wonder. Who, for example, would suppose that the tongue of the Limpet was so ingeniously framed, that it was a ribbon-shaped organ fully three inches in length, that its teeth were spinous, and that there were three rows of these; that further, the teeth of the middle row were cut into four points, and those of the external rows, (which are not exactly opposite to or continuous with those of the middle series, but alternate with them,) were cut into two points only? *

This curiously toothed tongue “is never protruded beyond the margin of the lips. It seems to be used

* *Vide* Gosse, “Nat. Hist.”

for rasping down the food ; and in proportion as the anterior prickles are worn away in this operation and absorbed, another portion of the tongue is brought forward to supply its place ; but that there may be no deficiency in its length, we find the apex soft and muscular, where in fact a continual growth and addition are going on.

“ When a Phytophagous Gasteropod is about to eat, it thrusts forward, and to a certain extent evolves, the spinous tongue, protruding at the same time the lip on each side, by which the tongue is compressed and forced into the form of the bowl of a spoon. The food is now taken hold on by the lips, drawn forwards and retained by the prickly tongue, and simultaneously pressed against the upper horny jaw, by which means a portion is bitten off, sometimes with a very audible noise. The detached morsel is then passed along the tongue, torn and rasped down by its sharp prickles, and, forced on by the peristaltic motion of the organ, and by the retropulsive action of the adjacent muscles, the mass is made to enter the gullet. At the entrance of this canal, there is an uvular caruncle, which is probably the seat of the animal's taste ; and on its side a pair of lobulated salivary glands, or sometimes two pairs, which have each a single excretory duct, to convey their peculiar secretion into its upper part, to lubricate and soften the mass. The gullet is a muscular canal, lined interiorly with a mucous coat, presenting, indeed, the same structure as the whole

alimentary canal, and is generally plaited in a longitudinal direction." *

Any one who has clambered over rocks by the sea-side must have been struck with the peculiar appearance they frequently present of having been bored into a number of holes, to a depth frequently exceeding half an inch. Now, it is a curious circumstance that these excavations in the solid stone are formed by the Limpet. The animal lies in these—sleeps all day long, and awakens at night to go abroad in search of food.

This singular fact was first made known by Mr Lukis, of Guernsey; a gentleman whose studies have done much towards enlightening us upon several hitherto obscure portions of Natural History. He says :—

“The locomotion of the Limpet may be ascertained by marking one individual to avoid mistake, and then observe its cautious roaming, and regular return to its favourite place of rest, where the shell will be found exactly to correspond with the surface of the rock to which it is attached. Here it will rest and sleep, and only relax its strong adhesion to the rock, when the muscular fibre becomes exhausted by long contraction, in which state a sudden blow, horizontally, will easily displace it. A fact, known to fishermen, and poor who use them for food, is, that they are more easily collected in the night-time than in

* Johnston, “Int. to Conchology,” p. 328.

the day. May not this be the period of roaming for food, as well as when covered with the tide?

“The march of the Limpet is slow and formal; and whenever the cupping process is renewed, the posterior end of the shell is brought into contact with the rock, which is of a soft nature, and will receive the impressions of its denticulations. The track of an individual placed under surveillance was thus made visible over a space of several yards, possessing the same regularity and disposition, and was further remarkable for the constant revolutions on its left.

“The tracks of the Limpet on granite and other hard rocks, present, at first sight, the same appearances; but, on a closer examination, they are found to differ. When first observed in 1829, a large portion of a fine-grained sienitic rock was traced over by these shells: the remainder was plain, and appeared varnished with a thin coating of some kind of fucus, without any markings upon its surface. As no *Patellæ* were at first discovered, and the isolated situation of the rock prevented any from reaching it, I was at a loss to explain these appearances; but, after some search, a fissure was found at the north end, where five or six Limpets had affixed themselves, each having a direct road leading to their pasturage ground. By the help of a glass, the markings visible on the rock were discovered to be the remains of the above fucus, which had been eaten through or trodden down by these animals in their excursions, and which retained the indentures of their shells. The edge of

the vegetable surface was then examined, and found to be nibbled in a circular manner, resembling the anterior margin of the shells.” *

By this mole-like burrowing in the rock, the Limpet is enabled to resist the violence of the waves, and also to prevent birds of prey, as gulls and others, from destroying him. This they are apt to do by forcing their bills under his shell, when he, not anticipating danger, looses his muscular hold, and allows his testaceous canopy to be raised above the surface of the stone.

If suddenly disturbed, the Limpet has the power of ejecting a cement, by means of which it glues itself to the rock so firmly, that, according to Reaumur, a pressure of twenty-eight to thirty lbs. is required to overcome this adhesive force. Whenever the young zoologist wishes to capture a specimen, he should endeavour to fix upon one asleep. Let him then softly insinuate the blade of his knife under its shell, and tilt the animal suddenly over. Should the surprise have been ineffectual, it is useless to make for the present another attack upon the same animal, for he would permit his shell to be chipped into a thousand bits before he would abandon his hold.

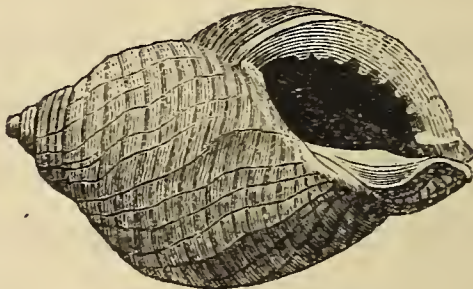
Wedged among rocks and loose stones, we frequently meet with large shells of the *Buccinum undatum*,† a species of Whelk. These are made pretty often to serve as dwelling-places to adult and

* “Mag. Nat. Hist.,” vol. iv.

† *Buccinum*, so called from its resemblance to a conch shell.

corpulent Soldier-Crabs. The length of a specimen now before me measures four and a-half inches. It is completely covered on the outside with Barnacles and small Mussels, while the interior is lined with a very delicate zoophytic crust, forming a kind of reticulated veil, beneath which lie several tubes of the *Serpulæ*.

Closely resembling this shell in general formation, though of considerably smaller size, is the common Dog-winkle (*Purpura lapillus*). The colour of this mollusc varies greatly. In some, the prevailing tint is white, in others, yellow or deep orange. Not unfrequently the shell is prettily ornamented with spiral bandings of chesnut or dark brown. No small



COMMON WHELK (*Purpura Lapillus*).

interest is attached to this little creature, from the belief that it supplied the purple dye for which Tyre was famous over the world. But here, as elsewhere, we may avail ourselves of the labours of our predecessors. A late writer says:—

“The most beautiful dye-stuff of antiquity was the Tyrian purple, so called from the place of its discovery and chief manufacture. I should rather have said, perhaps, place of its reputed discovery, for its

records are not reliable. The Greeks were by far too vain a race to admit that any great discovery did not originate with themselves. They attribute the discovery of the Tyrian purple to Hercules (500 B.C.), or rather to a little dog belonging to Hercules. As the story goes, this little dog, happening to wander along the Tyrian sea-shore, came back with his mouth all purple, and the nymphs of Tyras, a favourite of Hercules, were so delighted with the colour, that she bade him see her no more until he brought her a robe dyed purple, like the colour of his little dog's mouth. What would an enamoured man have done when thus conjured? How much more a demi-god? Hercules promised to oblige her if he could; so tracking the little dog's footsteps to see where they led, and what he would set about, he followed him to the sea-shore, where the animal began to eat shell-fish of two peculiar sorts—the *Buccinum* and *Purpura*. Hercules is reported to have thereupon collected some of these shell-fish, and extracted from a receptacle in the throat the celebrated Tyrian purple. In this way the Tyrian dye-stuff continued to be obtained by careful dyers; some however, less conscientious than Hercules, pounded the shell-fish in a mortar, and incorporated the fine dye-stuff with other animal juice."

The same writer also states, that, "in order to impart the last shade of beauty, the juice of both shell-fish (*Buccinum* and *Purpura*) is necessary." But this is an error, the latter only being requisite for the purpose.

Should any one, after a perusal of this description, feel desirous to procure a few spots of royal purple, his wishes can be readily gratified, by following the directions of a naturalist who flourished two centuries ago. This was William Cole, who appears to have been the first, in modern times, to discover that the common Dog-winkle yielded the famous dye of the ancients:—

“Having supplied yourself with a few of these animals, break the shells with a smart stroke with a hammer, and then throw them into some fresh water, in which they quickly die; care, however, must be taken so as not to crush the body of the fish within the shell. The broken pieces being picked off,” says Mr Cole, “there will appear a white vein, lying transversely, in a little furrow or cleft next to the head of the fish, which must be digged out with the stiff point of a horse-hair pencil, being made short and tapering. The letters, figures, or what else shall be made on the linen (and perhaps silk too), will presently appear of a pleasant light-green colour, and, if placed in the sun, will change into the following colours: that is, if in winter, about noon; if in summer, an hour or two after sunrising, and so much before setting, for in the heat of the day in summer the colour will come on so fast that the succession of colours will scarcely be distinguished. That to the first light-green, it will appear of a deep-green, and in a few minutes change into a sea-green; after which, in a few minutes more, it will alter into

a watchet-blue; from that, in a little time more, it will be of a purplish red; after which, lying an hour or two (supposing the sun still shining), it will be of a very deep purple red, beyond which the sun can do no more. But then the last and more beautiful colour, after washing in scalding water and soap, will (the matter being again put into the sun or wind to dry) be of a fair bright crimson, or near to the prince's colour, which afterwards, notwithstanding there is no use of any styptic to bind the colour, will continue the same, if well ordered, as I have found in handkerchiefs that have been washed more than forty times, only it will be somewhat allayed from what it was after the first washing. While the cloth so writ lies in the sun, it will yield a strong and fetid smell, as if garlic and assafoetida were mixed together."

Mr Gosse, after detailing some entertaining experiments with the *Purpura*, makes the following remarks:—

"I have seen it stated, that if the cloth be washed in scalding water and soap, it comes out from the lather changed from the reddish purple hue to a fair bright crimson. With me, however, the soap and the hot water had no appreciable influence in brightening the colour. My experiments were performed in winter, and I will not affirm that the intensity of a summer's sun would not in some degree have modified the result. There appears to me one objection to this material ever having been used to dye large

surfaces of uniform colour; for, from the admixture of mucous with the colouring matter, when any quantity of the latter is collected, the hue is found to imbue the cloth in a mottled or blotched manner, some parts being much darker than others. What method the ancients had of avoiding this appearance, I do not know."

But we must not conclude this chapter without noticing a curious property possessed by this mollusc. This is its extraordinary voracity, a property noticed by old writers like Pliny, and confirmed by Cuvier, and other modern writers. Mr Sowerby thus describes its mode of piercing:—

"Gliding stealthily among the sea-weeds and stones, it" (the *Purpura*) "seeks its prey, and woe to the small Winkle, Limpet, or *Trochus*, that comes within reach of its terrible proboscis. It will bring the aperture of its own shell opposite to that of its victim, and then, introducing his apparatus, never leaves it until all the soft parts are transferred to his capacious stomach. But even where no aperture or door leaves the smaller mollusc open to the attack of his enemy in that way, he is by no means deterred by this little difficulty; for if the object of his attack be a Limpet, firmly attached to a stone, or a Bivalve tenaciously holding its shell closed, he will manage to perforate the shell, and through the hole draw the quivering substance. Mr Spence Bates related to the authors of the 'British Mollusca,' that by way of experiment he placed a *Purpura* in a vessel of sea water, in company with a

Mussel, and observed the result. In a short time the *Purpura*, finding the Mussel was not at all open to his advances, and that the valves of the shell were so firmly drawn together as to leave no chance of effecting an entry between their edges, began to think of attacking them from without. Seeking a portion of the outer surface free from epidermis, he commenced boring. His human observer repudiating the policy of 'non-interference,' removed him, and turned the Mussel over, placing that valve uppermost which was most covered with the horny protection; the creature soon managed to turn over the huge body and shell of the Mussel, and resumed his operations at the point where he left off when disturbed; and he did this repeatedly after similar interruptions. At last, quite satisfied that the breach would in time be effected in that way, Mr Bates resolved to wait no longer for the process, but at once give the voracious shell-fish an opportunity of satisfying his appetite, at a smaller demand of exertion from itself and of patience from its observer. To this end he cut the muscles of the Bivalve, so as to deprive it of the power of keeping its valves closed. Its fate was thus accelerated; it was now at the mercy of its enemy. The latter no sooner perceived the valves open, than, leaving his former work of boring, he seized his advantage by inserting his trunk between the valves, not in this instance acting upon the general rule, that the enjoyment of an acquisition is increased in proportion to the difficulty and trouble of obtaining it."

Now, any person reading the above graphic sketch by Mr Bates, would naturally be inclined to look upon the *Purpura* as an animal possessing rather more than an ordinary share of intelligence or instinct. This feeling, however, will be considerably modified after perusing the following incident, which lately came under my own observation.

In order to give my Blennies a treat by change of diet, I cut open a large-sized Mussel, and let it drop to the bottom of the tank. The fish soon caught sight of this object, and tore away with great eagerness the quivering flesh of their late companion, and eventually left the empty shell overturned among the pebbles. A *Purpura* shortly thereafter gliding along, took up his position in one of the valves. He remained firmly fixed there for several days, and succeeded in boring through the shell, doubtless expecting to get a fine *bonne bouche*. In this, of course, he was mistaken, his labours being entirely unrewarded, except by receiving my sympathy for his disappointed hopes.

Such a remarkable instance of instinct at fault I had never witnessed hitherto. It rivals the stories told of the hen sitting upon a piece of chalk, thinking it was an egg—"the flesh-fly, that deposits their eggs upon the blossom of the carrion plant, where the young must inevitably perish from hunger, instead of real flesh"—or the poor bee, that settled upon an anemone, thinking it was a flower of the garden, and so perished.

CHAPTER III.

STAR-FISHES.

“ The prickly star-fish creeps with fell deceit,
To force the oyster from his close retreat,
Whose gaping lids their widen'd void display;
The watchful star thrusts in a pointed ray,
Of all its treasures robs the rifled case,
And empty shells the sandy hillock grace.”

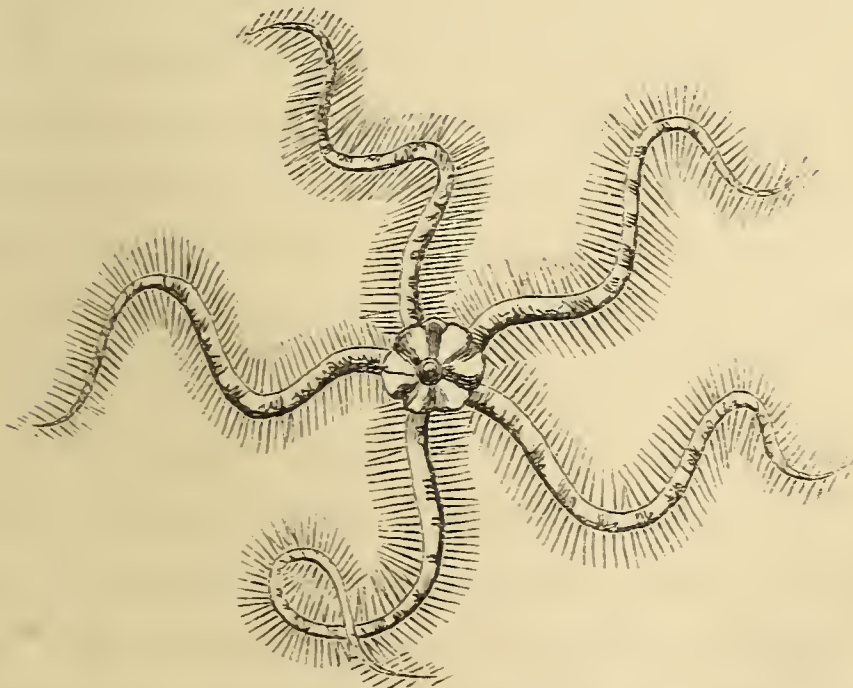
My first acquaintance—scientific, at least—with this class of animals commenced at North Berwick; a place dear to every naturalist, from having been the residence and scene of study of Dr Johnston, the accomplished historian of “British Molluscs.” Finding, on a certain occasion, that I should have to wait three hours for a train to Edinburgh, I made for the shore, full of that relish for observation and zeal for discovery which my devotion to marine objects had by this time inspired. Luckily, the tide was favourable to permit my getting out a considerable distance on those long standing ledges of rocks that occur in this, as in so many other parts of the east coast of Scotland. I saw vast numbers of large and gor-

geously-tinted *Actinice*, flowering at the base of many a pool. I saw, besides, scores of Star-fishes, such as the common Cross-fish (*Uraster rubens*), the purple Sun-star (*Solaster endeca*), and many others, lying apparently dead; so listless did they seem, among the dense masses of Bladder-wrack that here grows so profusely. There were many other sea-wonders then new to me—some wedged in secret crevices of rock, and others lying in little pools. But what, most of all, attracted my attention on this afternoon, was a little object that I discovered on suddenly turning over a piece of sandstone. I thought, at the time, that it must be some species of marine spider, which had, by some accident, been squeezed into a flattened shape. On attempting to take it up with my fingers, one of its legs snapped, and the animal dropped down. I searched for another specimen, and having found one, was, I imagined, handling it very tenderly, when a similar fate befell it. Resolved, after finding a third, to exercise greater caution than ever, I thought the most ingenious method would be to slide the blade of my knife slowly under his body, which was about the size of a pea. This contrivance, I was happy to find, proved perfectly successful, and raising the little creature, quite uninjured, I laid him gently upon a clear frond of silky *Ulva*, to examine my prize through a pocket-lens. I was greatly interested in the stranger, and carried him carefully home. I placed him, of course, in my Aquarium; but, although he crawled about for a while apparently at home, he grew sud-

denly indisposed, and, to my regret, died in little more than three hours after his admission.

The animal proved to be, not a Sea-spider, as I had imagined, but a curious species of Star-fish (*Ophiocoma rosula*), the common Brittle-star. The fragility exhibited by the first specimens I caught at North Berwick, and which I, at the time, attributed to my rough handling, was due to what some writers have not hesitated to term a suicidal tendency; the animal apparently preferring to break into pieces, before it would submit to be captured. Never, indeed, was a more timid little creature seen on land or sea.

The indifference it exhibits in throwing off its limbs is almost as great as that of the hydroid Polype. Beside the somewhat questionable recommendation conveyed in such a quality, it directly commands our admiration, from being one of the most beautiful Star-fishes found upon our shores. The variety of



COMMON BRITTLE STAR (*Ophiocoma Rosula*).

its colours make it a most delightful ornament to the Aquarium.

Professor Forbes gives, in one of his works, so humorous an account of his early experience of an individual of this family (*Luidia fragillissima*), that I am assured my readers will be obliged to me for transferring it to these pages. I am the more induced to do this, from the fact, that the work from which the extract is taken is not very accessible to the general reader, especially when at the sea-shore. The Professor observes :—

“ It is the wonderful power which the *Luidia* possesses, not merely of casting away arms entire, but of breaking them voluntarily into little pieces, with great rapidity, which approximates it to the *Ophiuræ*. This faculty renders the preservation of a perfect specimen a very difficult matter. The first time I ever took one of these creatures, I succeeded in getting it into the boat entire. Never having seen one before, and quite unconscious of its suicidal powers, I spread it out on a rowing-bench, the better to admire its form and colours. On attempting to remove it for preservation, to my horror and disappointment I found only an assemblage of rejected members. My conservative endeavours were all neutralised by its destructive exertions ; and it is now badly represented in my cabinet by an armless disk and a diskless arm. Next time I went to dredge on the same spot, determined not to be cheated of a specimen in such a way a second time, I brought with me a bucket of cold

fresh water, to which article Star-fishes have a great antipathy. As I expected, a *Luidia* came up in the dredge, a most gorgeous specimen. As it does not generally break up before it is raised above the surface of the sea, cautiously and anxiously I sunk my bucket to a level with the dredge's mouth, and proceeded, in a most gentle manner, to introduce *Luidia* to the purer element. Whether the cold air was too much for him, or the sight of the bucket too terrific, I know not, but, in a moment, he proceeded to dissolve his corporation, and at every mesh of the dredge his fragments were seen escaping. In despair, I grasped at the largest, and brought up the extremity of an arm with its terminating eye, the spinous eyelid of which opened and closed with something exceedingly like a wink of derision."

I may add that Joppa and its neighbourhood is not only extremely rich in varieties of Brittle Star-fishes, but in good specimens of the true Star-fishes, as the Common Sun-star (*Solaster papposa*), the Purple Sun-star (*Solaster endeca*), the Rosy Cribella (*Cribella rosea*), and the Common Cross-fish (*Uras-ter rubens*).

If the reader has perused the prefatory motto to this chapter, he will be reminded of the popular belief entertained regarding the power of the Star-fish to prey upon the Oyster. The poet, in this, as in so many other cases, has not invented a story, but availed himself of a belief that has been transmitted from very distant periods. Indeed the Admiralty

Court of England, in days of old, threatened a severe penalty upon those "that do not tread under their feet, or throw upon the shore, a fish which they call a Five-finger, resembling a spur-rowel, because that the fish gets into the Oyster when they gape open, and suck them out."

The question as to whether it preys upon the Oyster or not, has given occasion to no small discussion even amongst scientific men. Some deny the alleged fact altogether, while less sceptical observers are unable to understand the mode in which the Star-fish could injure an animal apparently so capable of self-defence as the Oyster. According to certain authors, the Star-fish encircles the Oyster with its "five fingers," and by some clever process of suction destroys the unfortunate mollusc. Others, again, maintain that the first step of the attack is the injection of some marine chloroform between the shells of the Oyster, and that, during the insensibility that follows, the Star-fish effects an entrance.

Such are the opinions of learned authorities upon the matter; but the young zoologist may be reminded, that he will occasionally obtain some trustworthy hints from a class who make no pretence to scientific accuracy—namely, fishermen. Some of these, with whom I have conversed, are of the same opinion as Bishop Spratt, and believe that when the Oyster is gaping the Star-fish insinuates a finger, and hastily scrapes out the delicious *bonne bouche*; nay, further, maintain that the Star-fish is far from being at all

times successful. Very often, especially when there has only been one ray inserted, the frightened Oyster grasps it with all his might, and obliges his discomfited opponent to retire minus a limb.

If the writer might venture to suggest an opinion, he would express his belief that the following is the correct account of the state of matters. He believes, with the fishermen, that frequently the Star-fish begins his attack by merely inserting one arm; but he does not believe that the Oyster ever, under such circumstances, escapes with life. Let us suppose the Star-fish to have succeeded in insidiously introducing a ray within the shell of the apathetic Oyster, and that the Oyster immediately resented such intrusion by closing his shell with all the force he can exert. The opposite argument at this stage is, that the intruder is obliged from pain to abandon his hold, and even to pay for his audacity by the forfeit of a limb. But against this we advance the notorious fact, that the Star-fish, like so many marine creatures of a similar organisation, is remarkably indifferent to pain. In short, I believe the true explanation to be, that the Oyster cannot sustain such continued muscular exertion for nearly so long a period as the Star-fish can tolerate pain, and that, consequently, the latter is in the long run successful.

Before concluding this chapter, I must observe that dried specimens of the Star-fish are very interesting objects to look at, especially when held before the light of a window or a moderator lamp. The

beauty of the intricate net-work they possess will be very apparent even under the moderate magnifying power of the ordinary hand-lens.

Mr Wood mentions a very ingenious method of procuring a perfect skeleton of the Star-fish. This is, by taking an individual and placing it near an ant's nest. In the course of a few days, it will be found that the ants have nibbled the soft parts completely away, leaving the skeleton as clean as if it were an osseous one, carefully dissected, and afterwards incarcerated in spirits.

I ought already to have observed, that wherever Star-fishes are introduced into the Aquarium they ought to be very young specimens, unless the tank is of a considerable size.

CHAPTER IV.

ACALEPHÆ (*Sea-nettles, or Jelly-fish*).

“ As floating by or rolling on the shore,
Those living Jellies which the flesh inflame,
Fierce as a nettle and from that its name.
Some in huge masses, some that you may bring
In the small compass of a lady's ring.
Figured by hand divine—there's not a gem
Wrought by man's art can be compared to them ;
Soft, brilliant, through the wave they glow,
And make the moonbeams brighter where they flow.”

CRABBE.

THERE are few persons, whether students of marine life or not, that are altogether strangers to the charm of leaning idly in a clear summer's day over a boat's sides, and of looking down upon the bright sands below. The cloudlessness of the sky, and the sultriness of the atmosphere, are in unison with the calm mood of the hour. As you dip your hand into the water, and experience a delicious sensation of coolness thrilling through you, you can hardly imagine the sea to be a distinct element from your own. I must confess, for my own part, to have found it easy under

such circumstances to believe the sea to be as dry land, through which one might travel at will. Not a silvery fish darted by, but I could have supposed it breathed upon air like a bird : the weeds waved as gently as if it were a breeze of west wind blowing over a clump of heather : nay, the stones, save for their shelly crusts, looked like the pebbles on the beach.

Although it is, of course, impossible to realise such a fancy, we are not altogether incapacitated from forming some tolerably accurate conception of the floor of that untrodden sea vault, at a depth far below what the quickest eye can pierce, even on the calmest day. Sea-speculators in the olden time, were obliged to draw upon their imagination, or to trust to the doubtful evidences of the lead or anchor. In our day, the rapid advances of geological knowledge has enabled a good, though as yet an unrealised view to be taken of that *terra incognita*. We have not space nor inclination, on this bright day, to pursue the latter track—to travel over mountains higher than the Dhawilghiry, to descend into valleys wider and deeper than the Mississippi, or to encounter those marvellous *rivers* that float through the heart of the sea. In limiting ourselves to what has been actually visited—in discoursing only of such curiosities as have been brought home by actual travellers, we must not in this place omit to notice the high position occupied among such hardy explorers by one of the most eminent of living zoologists. We refer to M. Milne-

Edwards. Unlike many who can write and converse pleasantly in snug laboratories and easy studies, or who, like myself, run no inconvenience, far less any danger, in their humble researches at the beach, this famous Savan has shewn more ardour than the most zealous pearl-fisher, in pursuing his investigations into marine wonders. Protected by an ordinary diving-bell, he has descended into the depths of the sea, and returned laden with specimens the like of which had never been seen before.

But, pursuing the idea with which we opened this chapter, let us endeavour to form some conception of the character of that ocean life that lies in the dozen miles intervening between us and the Lomonds of Fifeshire. We are, of course, still in the boat, and within a few yards of the beach; nevertheless, we can imagine ourselves armed with even a freer passport than the diving-bell of Milne-Edwards.

Behold! we are down, and upon the sands. What a variety of life meets us! is our first reflection. On every side, wherever we turn, our eyes are dazzled with objects, the appearance of which in their native element is so unlike what we had imagined them to be; nay, the greater number of objects we meet is perfectly new to us. There float by genuses of animals, not a species of which any zoologist ever saw. Gorgeous sea-weeds bloom with a richness and flavour which we believed it only possible for sun-bred flowers to exhibit. We must add, for the credit of mother Earth, however, that sights less pleasant are

equally abundant. Dark, ugly forms dart past us, with bright, cold eyes and glancing teeth, that we never wish to look upon any more. Then there are gnarled trunks of what were once noble forest trees, still clinging with strong roots to their native soil,* that has been for ages submerged under water. The sun once shone on those leafless branches; birds sung and nestled among them. In place of such occupants, a sea-plant now waves or a mollusc creeps; or frightened bands of small fish fly for shelter, as sparrow and thrush from hawk or heron did before: for, in the sea as elsewhere, authority is still maintained by

“ the simple plan,
That they should take who have the power,
And they should keep who can.”

But now we stumble across something that recalls other associations. That anchor is, perhaps, the sole existing fragment of what was once a noble ship; and our sea journey assumes a sadness that it had not when we set out. We are reminded of what the poet says:—

“ Shipwrecks and their spoils,
The wealth of merchants, the artillery
Of war, the chains of captives, and the gems
That gleam'd upon the brow of beauty; crowns
Of monarchs, swords of heroes, anchors lost
That never had let go their hold in storms;
Helms, sunk in ports, that steer'd adventurous barks
Round the wide world.”

* *Vide* Appendix.

. . . . “ Bones of dead men, that made
A hidden golgotha where they had fall’n
Unseen, unsepulchred, but not unwept
By lover, friend, relation far away,
Long waiting their return to home and country,
And going down into their fathers’ graves,
With their gray hairs or youthful locks, in sorrow,
To meet no more till seas give up their dead ;
Some, too—ay, thousands—whom no living mourn’d,
None miss’d, waifs of the universe, the last
Lorn links of kindred chains for ever sunder’d.”

But we must halt here, and return from an imaginary expedition, to the upper air. We are on, and not in, the water. The sun is still high ; but a gentle breeze has sprung up, and we call to remembrance our having left home with some intention of work.

Well, I commence my labours by producing a small ring net, which I pass several times through the water. See ! in a short time I have succeeded in capturing the very thing I want—a fine little specimen of the Medusa, or, as it is more familiarly known, a Sea-blubber, or Nettle-fish.* It is the commonest species of the great family of Acalephæ to be found on the British shores, and, like many other animals, is more curious in its construction than our familiarity with it would lead us to suppose.

The most accurate idea of the form of a Medusa is presented by a miniature umbrella. The comparison extends further than as regards mere shape, for whenever the Medusan wishes to ascend, it executes a series of movements exactly like the brisk closing

* *Vide* Appendix.

and opening of an umbrella. When again about to descend, it turns gently over and sinks down, stick uppermost.

The *Acalephæ* possess one curious property, which made them alternately objects of superstition and admiration; this is their luminosity. Many a wild theory was advanced in days of yore, to explain this curious oceanic phenomenon, of which the following lines give no exaggerated picture:—

“ The luminous life
That makes the dark nocturnal ocean bright
With constellated clusters of rare things,
Group'd or apart; seeming in lustrous grace
Fantastic wreaths of many coloured gems,
Instinct with living fire;—or here and there,
Glittering in golden glory;—flashing forth
Metallic white, or tremulous silver, cinqued
By ambient tints of sapphire, pink, and blue.
As if some opulent spirit of the sea
Had, from his treasury of precious stones,
Flung up his choicest treasures on the waves,
To bathe their beauties in the meek moonshine.”

The *Mamaria scintillans* is the species by which this phosphorescent property is most remarkably exhibited. Our readers may perhaps be obliged to us for a prose description of the appearance these animals present, from the pleasant pages of Miss Pratt:—

“ Beautiful as are many of the creatures of the sea, none are more lovely than the *Acalephs*. Now they may be seen in the darkness of night moving with most graceful ease, like so many resplendent orbs, shining singly, yet gliding from place to place; and

now combined in vast multitudes, forming a broad sheet of light. The vessel glides in amongst them, or the oar throws up the white foam, and a shower of stars rises but to fall a stream of living brightness. Down below the surface these jellies seem like balls of silver or gold: sometimes, as in the Girdle of Venus, of the blue Mediterranean, appearing like a riband of flame of several feet long; or as in the yet more luminous *Pryosoma*, enabling the voyager to read by their light as he stands by the cabin-window of the ship. Some of the larger species are described as having the resemblance to white-hot shot, visible at some depth beneath the surface; our own rocky shores are sometimes studded with them as with diamonds, and many who have trodden on the tuft of sea-weed have seen it shoot out in all directions rays of phosphoric light, which reminded them of a star of artificial fire-work."

We have yet to mention another property of the *Acalephæ*. This is the unpleasant one of stinging, whence comes the popular name of Nettle-fish. It was at one time supposed that this was natural to all, but the late Professor Forbes ascertained that it was confined to comparatively a small number of species. The stinging apparatus is formed of several hollow and (what we should not expect from the gelatinous character of the animal) muscular fibres. This apparatus, however, has been observed in species that have no urticating power.

In Scotland, where they are known as Scoudres,

the Medusæ attain a very large size. They are not unfrequently encountered by bathers, and under such circumstances, an embrace from one is neither safe nor pleasant. The following is the experience of an unhappy swimmer in the Frith of Forth:—

“In a moment it” (the Medusa) “enwrapped me, so that every part of my body was stung, and I could only disengage myself by tearing the animal piecemeal from me, at the peril of my hands, which became just as if I had poured vitriol on them. With great difficulty I swam back toward the shore; but when I reached the machine, I had not strength enough to dress, and was afterward led home by two persons. A medical friend ordered an application of oil and vinegar. Intense agony, as if stung by thousands of wasps, continued for about eight hours; and if it had not then terminated, I must have sunk beneath the torture. I felt an internal soreness, and was unable to eat for two days. The inflammation of the throat continued for a fortnight.”

This would, I imagine, have been the common Scoudre, which is very abundant on the Scottish coast. I have seen it very nearly the size above stated, and Dr Landsborough mentions that not only does it sting when in a perfect state, but that “*the threads retain their virulence after they have been separated from the animal by the force of the waves.*” In confirmation of this statement he narrates the following anecdote:—

“When I was in a boat one day, near Ardrossan,

I grasped, as it was carried past by the tide, what I thought was a rare and beautiful algæ, but I very speedily let go my prize. Major Martin, who was alongside of me, next grasped it as it passed him, but in a moment dashed it back into the sea. We looked at each other, and, notwithstanding the smarting of our fingers, laughed on finding that we had both greedily 'caught a Tartar.'"

It is only after a great storm, when thousands of these creatures are left stranded on the shore, that we are able to form some estimate of the vast numbers of them that inhabit the sea. It is then that we are led to ask what purpose they serve in the economy of nature. The humblest student of natural history is soon taught to discard the vulgar idea that for great ends great agents must be used. Accordingly, he does not find any objection to the Medusæ being concerned in the maintenance of important laws, from their delicacy and fragility. Some of their uses are now well known. In the first place, they serve, like many other animals, as food for beings larger than themselves. They form, for instance, favourite articles of food to the Greenland and other species of Whale. They also exude a slimy mucus, which serves as suitable nourishment to the young of less formidable prey. But the most curious function they discharge is their acting as protectors to various small species of fish. This observation was first made by Mr Peach. Formerly it was believed, from the number of little fish found in the stomachs of the

Acalephæ, that these had been devoured by them as regular prey. Mr Peach, as will be seen from the following extract, which we copy from Mr Gosse's "Tenby," delivers the Medusæ from the charge of voracity so long ascribed to them:—

“ Mr Peach's observations were made at Peterhead in the beginning of August; at which time *Cyanea (aurelia) aurita* and *Cyanea capillata* were so abundant in the harbour and bay, as occasionally very much to inconvenience the fishermen, and render it difficult to lift the oars, especially of small boats, from amongst them. Round these Medusæ very small fishes were observed playing—sometimes sporting round *C. aurita*, and quitting it on a sudden for *C. inscripta*. When an enemy came near occasionally two or three might be seen attending one of the *Cyaneæ*, and when attacked or alarmed, rushing under its umbrella, and among the tentacula, so as to shelter themselves in the large folds connected with the ova, where they remained until the danger had passed, and then emerged again to sport and play around their sheltering friend. When under the umbrella seeking shelter, they lay so close as to allow themselves to be taken into a bucket with the Medusæ—from beneath which, after a short time, they would come out and gambol, as while in the sea. In this way Mr Peach captured many young Whittings, measuring from less than an inch to two and a-half inches in length. It was evident that they resorted to the Medusæ for protection—and not, as sometimes

stated, that they are preyed upon by the glass-like creatures; and it is probably with a view to greater security that they prefer the stinging species, with its eight branches of long tentacula, and large fringed ovaries, to *Cyanea aurita*, with its single and frequently short row of delicate appendages. What then, Mr Peach asks, becomes of the paralysing influence of the tentacula of this Medusa on fishes? This, he thinks, opens a new field for observation. He believes, too, that the facts which he has observed, if not conclusive against, at least throw considerable doubt on the fish-eating propensities ascribed to the Medusæ; for he is convinced that in these instances the fishes resorted to the Medusæ as to protectors, and not enemies. In no instance did he observe a fish in the stomach of the Medusæ, but all were free to depart when they pleased.

“ In an instance subsequently recorded in his journal, Mr Peach states that a small Whiting, which was gliding round a small weak *Cyanea aurita*, was attacked by a young Pollack, or Baddock, whose movements it easily evaded by dodging round the Medusæ; a second Baddock, however, soon joined in the pursuit—but both were for some time baffled, until an unlucky move drove the Whiting from its poor shelter, and then a severe chase took place. The pursuers were joined by others, who followed like a pack of hounds, until the Whiting became exhausted, and was left by its enemies—who were unable to swallow it—to all appearance dead. In

this state the tide gently drifted it along with the *Cyanea*, until after a time it recovered, swam slowly to its protector, and took refuge as before. The pack soon observed it, drove it again into open water, and this time succeeded in really killing it. During their attack Mr Peach repeatedly threw stones among them, to induce them to desist, but so intent were they on the pursuit, that they dashed on unheedingly, although at any other time the smallest stone would have alarmed and driven them aside."

There is a current story regarding the Medusæ which is too amusing to be passed over:—"Professor E. Forbes had, a few years ago, been delivering some zoological lectures at a sea-port town in Scotland, in the course of which he adverted to some of the most remarkable points in the economy of the Acalephæ. After the lecture, a farmer who had been present came forward and inquired if he had understood him correctly as having stated that the Medusæ contained so little of solid material, that they might be regarded as little better than a mass of animated sea-water? On being assured in the affirmative, he remarked, that it would have saved him many a pound had he known that sooner; for he had been in the habit of employing his men and horses carting away large quantities of jelly-fish from the shore, and using them as manure on his farm, and he now believed that they could have been of little more real use than an equal weight of sea-water. Assuming that so much as one ton weight of Medusæ recently thrown on the

beach had been carted away in one load, it will be found that the entire quantity of solid material would only be about four pounds avoirdupois weight—an amount of solid material which, if compressed, the farmer might with ease have carried home in his coat-pocket.”*

* “Int. to Zoology.”

CHAPTER V.

SMOOTH BLENNY, GOBY, GUNNEL FISH, & ROCKLING.

“ Harmless warriors, clad in mail
Of silver breastplate, golden scale;
Upwards, downwards, now ye glance,
Weaving many a mazy dance.
Pretty creatures! we might deem
Ye were as happy as ye seem,
As gay, as gamesome, and as blithe,
As light, as loving, and as lithe,
As gladly earnest in your play,
As when ye gleam'd in fair Cathay.
And yet, since on this hapless earth
There's small sincerity in mirth,
And laughter oft is but an art
To drown the outcry of the heart,
It may be that your ceaseless gambols,
Your wheelings, dartings, divings, rambles,
Your restless roving round and round
The circuit of your crystal bound,
Is but a task of weary pain,
And endless labour dull and vain;
And while your forms are gaily shining,
Your little lives are inly pining!
Nay—but still, I fain would dream
That ye are happy as ye seem.”

HARTLEY COLERIDGE.

THERE stands in the centre of my Aquarium a piece of stone, projecting a couple of inches or so above

the surface of the water. This is an arrangement which I would strongly recommend to be adopted in other tanks; for not only is the variety and beauty of the whole thereby materially improved, but a sort of bank, if I may so speak, is afforded to such of the occupants as occasionally like to leave the water and bask in the open air. There are few animals that exhibit a greater readiness to avail themselves of this privilege than the Blenny—a curious little fish, that soon contrives to make itself a genuine favourite with his master. The Blenny is indeed, both from vivacity and intelligence, deserving of more consideration than it would appear, judging from the scanty space devoted to it in professedly zoological works, to have hitherto received.

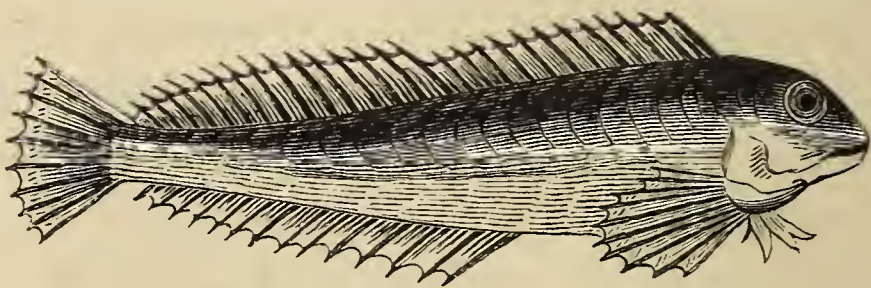
The Blenny, or, as it is variously termed, Shanny, or Tansy, occurs in great numbers in the rocky pools on our shores. It is the Sticklebat, or Tittlebat, of the fresh-water pond—the little fish that boys capture in scores, by means of a worm and pin attached to a bit of thread. The Blenny varies from two to three inches in length. The back is ornamented with exquisite markings, but the most characteristic feature is the brilliant crimson dot both on and immediately beneath either eye.

It is a very timid creature, and although, as will presently appear, able to overcome this nervousness when tamed, great caution is required in its capture. When desirous to procure a specimen, it is best to choose as small a pool as you can for your *hunt*.

Drop your net in at one end, and as the Blenny precipitately retreats to the other, give him chase. Having arrived at the extremity of his domain, he will endeavour to hide among the overhanging weeds; but if you hold your net across the pool with one hand, and with the other lift up a stone or beat the bushes, the little fellow will become alarmed, and, darting out, of course unwittingly falls into the snare prepared for him.

Having gained your prize do not handle it, but, placing your finger under the net, tilt it over the mouth of the bottle, and allow the wee Blenny to fall as gently as possible into the water. You need be under no uneasiness, after introducing him to the Aquarium, about the nature of his diet. He is far from being epicurean in his tastes. I supply mine with whatever is at hand—fowl, roast beef, mutton-chops, and the like.

The only caution I adopt in giving animal food to the Blenny, is to remove all traces of fat. I mince



THE BLENNY (*Blennius Pholis*).

their food into minute particles—fish mouthfuls—and having sufficiently moistened it, I place a morsel

upon a hair-pencil. This attention to their comforts the Blennies will soon learn to appreciate, and will, after a while, display at meal-times the sagacity of larger animals.

It is extremely interesting and curious to watch the movements of these creatures. There is one peculiarity which I am not aware other writers have observed, namely, the length of time during which they remain entirely out of water. I have seen some of the specimens in my Aquarium lie for several successive hours on the little ledge of rock quite motionless, as if sound asleep. All at once, of a sudden giving a peculiar twist of the tail, they spring into the lake, and roam through its shallow depths as if with a fresher zest for their native element. After a time they again come above water, there to rest as before. Even if not on the alert for their arrival, I easily learn when it takes place, from a peculiar cracking noise they emit, not inaptly represented by that occasioned by snapping two finger nails together.

It is possible, in the case of my Blennies, that their partiality to land over water may be in a great measure due to selfish motives; in other words, may arise from my attention to their diet. I should in justice, however, to higher motives add, that I have, from the day of admission, endeavoured to gain their confidence by other delights than those of the palate. The most sagacious of these schemes appears to be stroking their head and glossy sides with a camel-hair brush. Whenever I approach the tank, if

swimming, they immediately throw themselves upon the rocky bank, expecting a gentle touch; or wriggle their bodies upon the ledge situated near the upper portion of the bank, and there solicit the same favour. The prudence of choosing the latter locality is somewhat questionable; for, the little creatures being generally half in and half out of the water, with breast reclining on the smooth surface of the glass, the slightest stroke of affection often causes them to glide down upon the ever-expanded tentacles of a Daisy-anemone, and, in releasing themselves from such unpleasant neighbours, they run no small risk of being seized by the illuminated tenter-hooks of the Great Crassicornis. Such a misfortune actually befel a new-comer on one occasion, and literally caused him to turn pale with terror. It was, indeed, curious to see that, after releasing himself from the Actinia, instead of being nearly black as usual, he was transparent as a Shrimp.

Although I made sure the unlucky Blenny would not long survive this fright, I determined to try the effects of change of air. So, having placed him, almost breathless, on the palm of my hand, I carefully smoothed his coat, and thereafter deposited him in a tumbler of clean water. In a few hours I had the satisfaction to find his natural hue return, and in no long time the little fellow swam about as lively as ever.

I was once master of a Blenny whose insuperable shyness occasioned me a great deal of care. He was so timid, or modest, that whenever I approached him

with food he withdrew in great alarm, generally seeking shelter under a frond of dulse. Happening one day to observe the presence of a hole in the dulse, it struck me that it might be no bad plan to drop a morsel through it. The Blenny forthwith appreciated my consideration, and devoured mouthful after mouthful, as fast as it could be transmitted, until his hunger was completely appeased. Having once succeeded in inspiring a relish for a different diet to the ordinary one of the Aquarium, I was hopeful of ultimately getting his *mauvaise honte* removed, and of seeing him comport himself at eating hours with the gravity of his better bred companions. My expectations were more than fully realised; for, having once disposed of his superfluous modesty, the little fellow became a perfect nuisance in the republican community of which he was a member. All of a sudden he seemed inspired with the genius of mischief; and though to me, as an onlooker, it was rather amusing to watch his rough fun, its objects were far from well pleased. His ingenuity in annoying his brother and sister Blennies was untiring. Not a moment appeared to pass in which their harmless gambols were not interrupted by smarter slaps than were agreeable to such docile play-fellows. More than once the little rascal attempted to crop off some feathers of my pretty Sabella—a malicious design always intercepted by the keen vision of the assailed. My charming Daisy-anemones were kept in a state of continual irritation by the continuous flappings of

his tail across their cheeks. Patient and long-suffering as they were, such insults proved more than they could bear. Very eagerly did they strive to be revenged on their finny tormentor, but always without effect.

When my Pholas (of whom more anon) was quietly erecting his tubular bridge—an operation in which I took great delight—the Blenny did all in his power to interrupt the progress of the works.

I became at length convinced that such continued misconduct deserved punishment; so, catching the offender on a certain occasion with my nippers, just as the Giant-killer caught Little Jack, I held him in unpleasant proximity to my Crassicornis. The peccant Blenny immediately exhibited an extreme degree of alarm, which I, disposed to leniency, accepted as symptoms of sincere penitence, and immediately set him at liberty.

I grieve, however, to have to add, that after no long interval he again relapsed into his evil courses.

Thinking that perhaps a more liberal feeding would tend to make him less riotous, I placed him upon an unlimited diet, but with no beneficial result.

His hostility appeared to be especially directed against the youngest of the Blenny family, whom I took under my especial care, and christened Little Jock. It may sound somewhat doubtful, but I positively assert, that this little Blenny learned in a very short time to answer to his name. Upon calling to him, he would instantly make his appearance, and struggle to get his body on the ledge of the tank. *When I*

placed him on the palm of my hand, and titillated his little back with my soft pencil, he exhibited evident signs of pleasure.

I mentioned this most remarkable instance of tameness and docility to many of my friends. They all conceived that I exaggerated the fact, until they had ocular demonstration for themselves. Yet after all it can only take place among those "little romances in which natural history abounds—one of those narrations which, while believing, we almost doubt, and yet while doubting must believe." *

It will be found in a future chapter that my Blennies became very destructive. I determined I should let them exercise this newly developed propensity upon another of their companions; so I slid a Limpet off the rock to which it had affixed itself, and dropped the devoted mollusc on the bottom of the tank, shell downwards, leaving the fleshy parts exposed. There was immediately a rush to the spot, and after sundry bickerings with each other, one gave a grip at the "mantle" and made a slight rent in it—another and another did the same, the poor Patella always endeavouring to grasp at something to turn himself over. Had he been able to accomplish this, not all the fish in Christendom would have had the slightest chance of getting a bite at him; perhaps they would not be sorry for that, if I may judge from the Blennies, for, although they pulled and tugged and shook their victim, they did not make a hearty meal. As I

* Professor Forbes.

watched them at their operations, I could not resist a smile, as the anecdote which Hugh Miller narrates in his "Schools and Schoolmasters" passed through my mind, wherein he tells his readers, that some wags of Cromarty having become possessed of an eagle, stripped it of its feathers, and presented it to an old woman as "a great goose, the gift of a gentleman." Poor Dribble Drone (the old woman's name) accepted the gift with great delight, and when asked some time after how she had relished the bird, she replied that it was "*unco sweet! but, oh, teuch! teuch!*" And this seemed to be the opinion of the fishes, for although they exerted themselves laboriously to masticate their prize, they did not succeed in making much impression upon it; it being, as I thought, "unco sweet, but, oh, teuch! teuch!"

The Goby (*Gobius unipunctatus*), or, as it is popularly termed, One-spotted Goby, is a frequent occupant of the same pool with the Blenny. Its most characteristic distinction is the peculiar spot which appears upon its dorsal fin. When full grown it is much of the same length with the Blenny.

The Goby possesses the remarkable power of affixing itself to objects by means of a sucker, formed from the junction of its ventral fins. Unless the young zoologist keep this peculiarity in mind, he will frequently experience the chagrin consequent upon an unsuccessful hunt after any coveted object for the Aquarium. The tedious search that the Goby frequently demands is not only trying to one's

patience, but causes a great loss of time that might otherwise be usefully employed. For marine studies, it must be remembered, cannot be satisfactorily prosecuted, even if the student had ample leisure, without a due regard to the state of the sea. It is proper therefore, as regards the Goby, to give those simple directions that will generally lead to its capture without great loss of time.

Suppose, after arriving at the shore, you have fixed upon a pool likely to contain a specimen, and suppose further you actually see one—and of course introduce your net—your exultation is suddenly damped by noticing him disappear in the sand, below a stone. You immediately overturn the stone, and as soon as the disturbed water has settled, peer cautiously around. But the Goby has vanished; at least you can see no evidence of any motion in the water. You again survey the pool round and round, again explore the sand; but all to no purpose. You are not a little amazed in conjecturing where the little wretch can have gone to. Why, he has been before you all the time! Do you see that mass of amber-coloured jelly sticking to the stone you dislodged? That is the Goby; and, incredulous as you seem, you have only to introduce him to your bottle, where he will soon throw away all disguise, and swim happily enough in its narrow limits.

Being the owner of such a prize, you will scarce resist, as you walk along, holding up your bottle frequently in the light in order to have a peep at him.

In so doing, if you should observe that instead of amber colour, he has changed to dingy black—put on a “suit of sables”—do not be surprised, for such an alteration is of frequent occurrence with this interesting little creature, as my experience proves.

I beg most particularly to impress upon the young reader, if he wishes to capture either the Goby or Blenny, or others of like kind, to stand at a reasonable distance from the pool, and to watch earnestly for a glance of their forms darting about, before commencing operations. Should he have the good fortune to secure a specimen, let him not be content, but continue his search, and he will most likely capture others. Many a locality that to the inexperienced student seems barren, yields to the practised zoologist an ample harvest.

Of another species of Goby, the *Lepidogaster binaculus*, or Two-spotted Goby—a common occupant of rock pools of the Frith of Forth—we may quote the interesting account given by Dr Landsborough. The reverend gentleman is describing a dredge haul, and states :—

“There was one thing which we all admired, though at first, when I saw it in the boat, I could not conceive what it was; nor was it until it had appeared in all its phases that I discovered what it was in reality. On opening a Scallop, I observed one of the valves lined with what seemed *Cellephora pumicosa*, a zoophyte, but it was gelatinous; so that I concluded it might be some kind of spawn. On opening another

Scallop, I found that the white dots or cells had become blackish blue. On opening a third, I found that the generality of the dots, instead of adhering to the shell, were disengaged, and were swimming in a little water in the concave valve, like a number of sparkling diamonds. On applying a magnifying-glass, I found that I had got a shoal of little fish, and that their sparkling eyes were the diamonds I saw; moreover, that round the edge of the patch many of the dots were still adhering; and that round the head and eyes, which were prominent in the centre, the body of the little fish was wrapped, pretty much in the manner in which the cook sends up Whittings to table, with their tail in their mouth,—very much, I am sure, against the will of the Whittings, if they had anything to say in the matter, but a most easy and elegant position for those nascent gelatinous fish. It was in the disengaged state, however, that they chiefly excited our admiration. By the aid of a lens we saw that the two eyes were the sparkling diamonds; that the body, which consisted of transparent gelatine, filled with grey granules, dwindled away towards the tail: so that each little fairy fish of half-an-inch in length resembled a tiny pair of scissors. Prosecuting our investigations, I found them half grown, and at last full grown; so that I had the satisfaction of ascertaining, that the little beauties we had so much admired were the fry of *Lepidogaster binaculatus*—the little two-spotted Sucker-fish. How wonderfully the Lord teaches the feeblest of His creatures to pro-

vide for their own safety and that of their offspring! It is not an old weather-beaten Scallop that it takes possession of, but one that is fresh without and smooth and pure within. After it has entered, it certainly has some way of glueing the valves together, for it is not without difficulty that they can be torn asunder; neither is it imprisoned, though the apartment is thus shut against intruders: for, closely as the valves adhere, there are some little apertures about the ears of the shell, through which it can make its exit with its numerous family, or by which such little creatures as they feed on may in their simplicity enter."

I shall conclude this chapter, by stating that the pool containing a Blenny and Goby may very probably be at the same time occupied by two other animals well deserving notice. These are the Gunnel-fish, remarkable for its graceful motions, its beautifully spotted and riband-like figure, but, unfortunately, not adapted for the Aquarium; and the Five-beard Rockling. The latter is of more robust constitution than the Gunnel-fish, and thrives admirably in the tank, where its docility will soon render it a favourite.

CHAPTER VI.

PHOLAS, MUSSEL, COCKLE (*Cardium Edule*).

“ The mussel, often trimm’d
With orient pearls within, as thereby Nature show’d
That she some secret good had on that shell bestow’d;
The scallop, cordial judg’d; the dainty whelk and limp,
The periwinkle, prawn, the cockle, and the shrimp.”

DRAYTON.

No Aquarium, in my opinion, can ever be considered complete, that does not possess one or more specimens of the Pholas. For myself, I am so enthusiastic an admirer of this animal, that I regard the privilege of watching his mysterious movements as amply repaying all the trouble the most unmanageable Aquarium can ever cost.

With respect to other marine animals, we may be contented with watching the grace of their motions, the adaptation of slender limbs to various kinds of difficult movements, their elegance of form, or their surprising docility. But the Pholas has, in addition to these qualities, the recommendation that arises from something puzzling and undetermined. Much

ingenious speculation has been employed upon the manner in which an animal so constituted manages to perforate the rock which it inhabits.

“Probably upon few subjects in natural history does so much discrepancy of opinion still exist; and when the abundance of subjects every coast presents for our investigation is considered, it looks something like an opprobrium to the science of Zoology, that the question remains now just where it was forty or fifty years ago.”*

The *Pholas* is not, however, according to my experience, abundant at the present day on the shores of the Frith of Forth. I have seen many thousands of holes in different parts of the coast filled with empty shells, but the only places in which I have had the good fortune to find living specimens was at Wardie, situated between Trinity and Granton, and also in a seam of sandstone that runs towards the sea, at a little distance from the Salt-pans of Joppa. The attention of a visitor in search of specimens will be directed to a number of circular orifices in the solid rock, many of which are to all appearance completely filled. Should the act of placing a finger upon an orifice be followed by the emission of a little water, and at the same time a sudden feeling of hollowness be communicated to the touch, it is probable that the home of a live *Pholas* has been discovered. In order to carry away the prize intact, a careful exercise of both chisel and hammer are re-

* “Chambers’s Journal,” 1849.

quired. When come upon, the animal, naturally connecting the fate of his house with that of its occupant, will be found to have shrunk into the smallest possible size. The manner of his removal to the Aquarium should depend upon the manner of his extraction from the rock. If connected with any portion of his stony domicile, a cozy crib may be extemporised for him in some soft sea-weed; but if entirely detached, he had better be carried in a bottle. It may not be out of place here to remind the young zoologist of never omitting to carry a specimen bottle to the sea-side. After introducing the Pholas into the Aquarium it is advisable to place him as near as convenient to the edge, in order to have a better opportunity of watching his movements.

The first Pholas which I succeeded in capturing was quite detached, and lived for a fortnight in the tank, apparently in perfect health—being, as far as I could judge, perfectly contented. At the end of the second week of its confinement it came to a sudden and deplorable end. As an illustration of life in the Aquarium, I may relate how the catastrophe occurred.

One morning, I noticed that a little Fiddler-crab (Velvet Fiddler—*Portunus puber*) was missing from the impatient group that at that hour were daily waiting breakfast. Afraid he might be indisposed, I searched after the little fellow, but on discovering him he retreated in great precipitation to the opposite side of the tank, and there wriggling himself under

the sand, almost completely disappeared. Curious to ascertain what behaviour so unusual could signify, and not able to reconcile it to my first hypothesis of sickness, I lay down upon an adjoining sofa, that commanded a full view of the Aquarium. In the course of a very few minutes I observed a little elevation of the Crab's head, attended with a succession of rapid inquisitive glances all round. Apparently satisfied with the result of these observations, he suddenly threw aside his arenaceous covering, and deliberately advanced towards my gentle Pholas. In a moment he fell upon him with desperate violence. I looked on very eagerly; and assuredly, had I anticipated the tragical nature of the encounter, I should have speedily interfered. But the Pholas looked so formidable, being fully four times the size of its assailant, that it was only when the sharp nippers of the latter, had, in a space of time incredibly short, eaten away a considerable part of the soft, dainty cheeks, that I became thoroughly alive to the character of the attack and its probable termination. Grasping my Aquarium ferule, a slim stick of gutta percha, I struck the Crab so forcibly, that he made a hasty retreat. Great was my surprise and annoyance, however, to find that the injuries inflicted on the poor Pholas were so grave as to prove fatal.

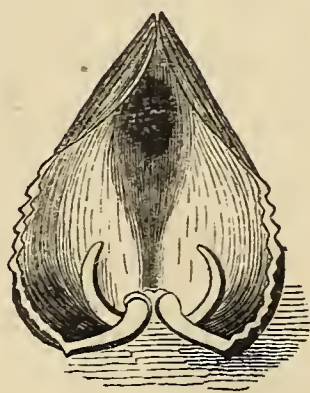
I may add, that the rascally Crab, as if conscious how severely he deserved punishment, and uncertain how long my vengeance might be imminent, entirely withdrew from observation. Indeed, several weeks

elapsed before he emerged from his hiding-place and presented himself at meal hours.

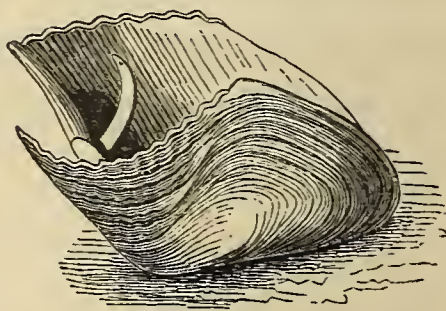
It might be supposed that, after so unfortunate an attempt at introducing the "Happy Family" style into my tank, I should never have repeated the experiment. But I began soon afterwards to imagine, and ultimately to believe, that the late disaster was not so much due to the depravity of Crab-nature in general, as to some extraordinary moral perversion exhibited by an individual. I accordingly resolved to introduce some fresh specimens of the Pholas; and after having done so, I had the satisfaction of observing that they and their suspicious neighbours lived upon good terms. This pleasant state of matters continued for several days. But, alas! the sanguine expectations I had begun to indulge in were speedily destroyed; for, on accidentally looking one day into the Aquarium, I saw a Crab quietly scooping out my prettiest Pholas. My displeasure was instantly exhibited by a thrust of the nippers, so forcible as to prove fatal to a Crab many times larger, had not the little rascal succeeded in skilfully evading the blow, and hastily withdrew for shelter to a dense thicket of grass. Being determined to punish him, I poked and poked about in all directions to discover his hiding-place, but I was ultimately obliged to abandon my search. Only one effectual means was then left me, to which I was obliged, much to my annoyance, to have recourse. As soon as I had collected a sufficient number of dishes—and really the

demand for basins, jugs, tumblers, saucers, and all sorts of ware, rendered the operation rather formidable—I began to empty the Aquarium. Having removed fish, molluscs, weeds, and the like, I completely withdrew all the water by the syphon (a simple tube of gutta percha), and at length came upon the object of my search, who did not submit to be caught without his best attempt at revenging himself, by nipping my fingers with his claws.

I now resolved to try the effects of solitary confinement, and I made up a cell for him in a tumbler, at the bottom of which I placed a few spoonfuls of sand and some *Ulva latissima*. I at the same time subjected him to a course of corporeal punishment, and had persevered in this for a few days, when, on looking down to my tank, now filled as before with its old occupants, I was astonished to see that one Pholas had entirely disappeared (with the exception of his beautiful articulated shell), and that another



Front View.



Side View.

PHOLAS SHELL.

was nearly empty. It was clear the poor Pholades had other enemies besides the Fiddler. In conse-

quence, I kept a sharp look-out to discover who these might be. In a short time I was furnished with ample evidence that the offenders were my shy, docile friends, the Blennies! foremost of which in the nefarious attack was the little rascal whose misdemeanours had, as stated in last chapter, occasioned such disturbance. But, indeed, they all displayed a remarkable voracity, and evidently looked upon a Pholas as a delicacy hitherto unsurpassed in their pretty full experience of a variety of diet. To that I must ascribe the great contention that prevailed among them. They strove for a mouthful with a greed that reminded me of the vultures in the Regent's Park at feeding-time. It being now of no use, as regarded the recovery of the victims, to suspend their proceedings, I permitted the Blennies to eat and fight as they pleased. In the general excitement, I more than once noticed a Blenny dive its head into the Pholas' shell, shake it to and fro with wonderful quickness, and ultimately roll head over heels. Another would more playfully seize upon a Pholas, and shake it as a dog does a rat. One of these offenders met with an unexpected retribution. It was my pretty Blenny, "Little Jock." I saw him busy at night, when giving my last look at the Aquarium, scraping the shell of one of the largest Pholades in my possession—the remains of an unfortunate victim in the late disturbances. Next morning I remarked the absence of his familiar face, and searched for him in every corner. In this I was unsuccessful, until I

accidentally overturned the big Pholas' shell, and there lay the little Blenny quite dead, after the fashion of the hapless Genevra. Whether his own weight, when inside, had toppled over the shell, or whether it resulted from a chance collision against a larger Blenny, or some other animal, I cannot tell. Suffice it that Little Jock was defunct.

We must now return to the consideration of those points regarding the Pholas that impart to it its peculiar and mysterious character; namely, the mode in which it perforates the rock which serves alike as

“Its dwelling and its sepulchre.”

Mr Sowerby, in his pleasant “Manual of British Conchology,” devotes an entire chapter to this subject, from which I take the liberty of making the following quotation, which will serve to bring the matter vividly before the mind's eye of the uninitiated reader:—

“Professor Forbes thus ably sums up the various theories which have been promulgated on this very interesting and difficult point:—‘They may all be classed under five conclusions: 1st, That the boring mollusca perforate by means of the rotation of the valves of their shells, which serve as augers; 2d, That the holes are made by rasping, effected by silicious particles studding the substance of certain parts of the animals; 3d, That currents of water, set in action by the motions of vibratile cilia, are the agents; 4th, That the animal secretes a chemical sol-

vent—an acid—which dissolves the substance into which it bores; 5th, That the combined action of a secreted solvent and rasping by the valves effects the perforations.'

"The most plausible reason" (says Mr Sowerby) "in favour of the first of these theories, is that given by Mr Osler, who describes the young animal first fixing itself by its foot, raising itself almost perpendicularly, and pressing the prickly part of the shell against the stone in a half-rotary motion, and thus adapting its motions to its advancing age, the size of the opening, and the progress of the work. Mr Osler goes on to say, 'The particles rubbed off, and which in a short time completely clog the shell, are removed in a very simple way.' When the projected syphon is distended with water, the Pholas closes the orifices of the tubes, and retracts them suddenly. The water which they contained is thus ejected forcibly from the opening in the mantle; and the jet is prolonged by the gradual closure of the valves, to expel the water contained within the shells. The chamber occupied by the animal is thus completely cleansed; but as many of the particles washed out of it will be deposited before they reach the mouth of the hole, the passage along which the Pholas projects its syphon is found constantly lined with soft mud.

"In further apparent support of this idea of the holes being made by the mechanical action of the valves, it has been noticed, that some of them are marked by rough grooves, such as might be produced

in that manner. On the other hand, however, it may be observed, that the 'rasping' points on the surface of the valves are never worn down, which must be the case if they were constantly employed on hard substances, as suggested; that in some of the species the shells are externally quite smooth; and that the holes, instead of being quite cylindrical, are fitted to the shells in such a manner as, at least when adult, to deprive them of the power of lateral action.

"The second theory, namely, that which endeavours to account for the wearing away of the rock by the rubbing of flinty atoms in the foot of the animal, has this important difficulty to encounter; namely, that after the most anxious microscopic researches, no such silicious particles have been found in the Pholas, although they do exist in some other families of boring molluscs.

"The third theory may be good as far as it goes, but it is inadequate in itself to account for the whole result. No doubt, currents of sea water between the shell and the walls of its habitation most materially aid, not only in clearing away the particles when dislodged, but also to some extent in dislodging them.

"As to the fourth, and perhaps on the whole the most popular notion, that of a chemical solvent secreted by the animal, it would probably puzzle the acutest chemist to find a solvent which would act equally on wood, clay, sandstone, chalk, and wax.

"The fifth theory, or that of the combined action of rasping and solution, combines the difficulty of both.

“Now it may seem presumption on my part, after so many learned opinions have been cited, *and the question left still undecided in the latest and most careful treatises*, to venture anything like a judgment of my own. ‘Who shall decide when doctors disagree?’ but I must confess that it does not seem difficult to imagine the Pholas making its way into its stony bed, by the simple process of *licking* a hole. Réaumur observed, that when he removed the living animal from its place, and put it in soft clay, it quickly before his very eyes buried itself in that substance. Although the stones in which some of the species burrow are certainly harder than the clay, yet it must be remembered that the clays in cabinet specimens are much harder than when under water; and that this sucking and licking, and rubbing with the foot, which is certainly of stouter material than the rest of the animal, would be powerfully aided by the action of the salt water. We see in the caves below cliffs, how water can excavate hard rocks when acting in circular currents, and we can easily imagine how it would act in enlarging a cavity already begun. In fact, we see, in the case of deserted holes of boring bivalves, instances of the enlarging power of small currents. If Réaumur’s specimens could so easily perforate the soft clay during the progress of a mere experiment, how shall it be difficult to understand perforation, by the same simple means, of a harder substance during the gradual growth of the animal? While thinking on this matter, it occurred to me to

try a very simple experiment, by procuring from the kitchen a piece of hearthstone—which the servant, by the way, observed was a very hard piece. With some salt water to assist me, I rubbed the surface with my finger, of course keeping to the same spot, and in a very few minutes' time, I had made a very sensible impression in the stone. I had not patience to carry the experiment any further; but as far as it went, it left no doubt on my mind that *with the foot alone*, without silicious particles, without a chemical solvent, and without using the rasping powers of the shell, our little animal could easily execute his self-pronounced sentence of solitary confinement for life."

With due deference to such an authority, I feel confident in my own mind that Mr Sowerby, and other writers who have also advocated this theory, are totally mistaken, and that Mr Osler's theory is nearer the truth, though it is not altogether correct. I have had excellent opportunities of watching a *Pholas* at work under singularly favourable circumstances, and I am enabled therefore to speak pretty positively upon the question.

In the general massacre of my *Pholades* by Blennies and Crabs, I was left with only a solitary specimen, seated, however, in a loose piece of rock; the syphon and upper portion of the shell being distinctly visible.

To ascertain whether the *Pholas* moved in the cavity, I used to place a pencil cross on the wooden base of the Aquarium, and a corresponding mark upon the white marbled baize beneath. To guard

against a possibility of either being accidentally shifted, I at the same time sketched on the latter the true position of the Pholas in the hole. By this check, I could tell at a glance if there had been the slightest deviation.

For two whole months, not a day passed that I did not look several times at the Pholas; and I can positively declare, that during that entire period the creature never moved, nor even oscillated its body, more than the eighth part of an inch, either right or left. At the end of eight weeks, however, upon peering into the tank, I saw that a change had occurred. The crosses exactly corresponded, but the position of the animal had varied! nay more, the valves, which in general were clean, now exhibited a furry or dusty appearance, shewing that they had been at work for several hours. Even while I stood, to my great delight, the boring operation was resumed.

Now, to see a Pholas loose in the tank, or quietly seated in the rock, extending and retracting his syphons, would fail to give one the slightest idea of his extraordinary appearance when enlarging his dwelling. He is quite a different animal, appearing to have suddenly acquired a most marvellous degree of energy and perseverance, forming so striking a contrast to his usual quiet, passive habits.

In the first place, he retracts his tube to, and even under the level of his shell—just as a man about to urge onward some heavy mass with his shoulders, would depress his head to increase and concentrate

his muscular power. Then follows an expansion of the neck, or upper part of the ventral border, from whence the syphons protrude. This movement closes the posterior portion of the valves below the hinge, and brings their serrated points together. The next act on the part of the animal, is to place his foot firmly at the base of the hole. When leaning forward, he makes a sweeping movement fully half round the cavity, and pressing firmly upon the umboes, which nature has strengthened for the purpose by two curved teeth, fixed on the inside of the valves. At this stage, he again reclines on his breast, and tilting up the shell as much as possible, he makes another motion round to his former position, leaning upon his back. By these intricate movements, which the *Pholas* appears to accomplish by a contraction almost painfully strong, it opens the rasping points of the valves. These execute a very peculiar scooping movement at the base of the cavity; and the animal having got so far, refreshes himself for further exertion by a short rest.

The foregoing observations were a great point gained in my investigation of the terebrating habits of this creature. It had begun to bore, there could be no doubt of that. The next question was, How long it would continue to do so, and would it bore *through* the rock? These questions were in no long time satisfactorily elucidated.

Just three days after the *Pholas* had begun its operations, I saw that the water in the tank had,

from some unaccountable cause, become opaque. Failing in my endeavour to clarify it by means of the syringe, I grew apprehensive that it might do injury to the creature in whose labours I was so greatly interested, and so lifted out the piece of rock in which he resided. In doing so, I raised it so as to command a view of the under side. Great was my surprise then, upon finding *the hole bored through!* I now placed the stone in a tumbler of water, at an angle of 45° , so that I could take in any change, not only in the base, but also in the upper portion of the animal, at the same glance.

During more hours than I care to mention, such was my eagerness, did I sit with the glass poised on the thumb and fingers of my left hand, my elbow resting on the arm of the chair, and a small lens in my right hand. Never was I so heedless of the fatigue that one position long maintained invariably induces, or so indifferent to the bad effect of too powerful a strain upon the eyes.

My Pholas continued to bore the whole period. The next day it was quiet, evidently reposing from its labours, and so it remained for a week. During the next six weeks it became restless, boring slightly every day, although at certain times its foot would suddenly slip through the aperture, to its annoyance and discomfort, I believe.

For several months past, it has been in the same position that it is at the present moment (March 1858)—with the lower portion of its shell, and its

delicate, fleshy foot, entirely protruding through the rock, as I have represented in the Frontispiece.

During the period in which the *Pholas* was actually engaged in boring, it continually threw out from its smallest (anal) syphon fine threads of apparently pulverised rock. These produced a very strange effect. Had my favourite been totally imbedded, I should naturally have supposed, as Mr Osler does, that in order to free itself from the soft particles that occlude its orifice, it would contract its syphon, then suddenly extend it, at same time blowing away the debris, and thus clearing the cavity. But such could not possibly be the case in this specimen, for the rock was shaped so that, as I have before stated, the whole of the syphons, and part of the valves, were always exposed, and never at any time entirely covered, even with the softened particles produced by the boring operation.

This phenomenon, therefore, evidently admits of no other explanation, than that there must be some pedal opening through which the creature draws in whatever collects at the base of the cavity, and expels it as above mentioned, and this without any filtration whatever.

I candidly confess that I have never been able to discover any pedal orifice; but upon no other supposition can I apprehend how it is that these threads lie about by hundreds in all directions, the animal ejecting them at least once in every quarter of an hour during the time it is at work; yet, when in a

passive state, or when its foot is through the aperture, no such threads are ever to be seen.

I am better able to state, from my own observation, that there can be no doubt it is with the shell, and not with any acid or flinty particles, that the creature bores the rock.

Professor Forbes held that if this were the case, the rasping points on the surface of the valves would soon be worn down—an appearance which, he says, never is seen. With due respect to such a name, I am convinced he was in error. Not only are the edges worn, but the rough surface is worn nearly smooth, appearing in certain parts of a shelly white colour, instead of a light drab, as my specimen proves.

But the reader may ask, If certain parts of the valves are worn nearly smooth, and the animal worked so vigorously, how is it they were not rasped through? This is a very natural question, and one that I put to myself repeatedly.

I have made frequent and careful observations with a powerful lens, while the animal was actually at work, in order to satisfy myself upon this point, and have always perceived that the particles of softened rock fell from and on each side of the *ligament* that binds the hinge, and extends to the lowest points of the valves.* Moreover, that this leathery

* The reader must keep in mind, that since I was watching the movements of my *Pholas* from beneath, my eye was as it were at the base of the cavity—for the hole was bored through, and allowed the foot, and a portion of the shell of the animal, to be distinctly seen.

substance always seemed scraped on the surface. I cannot, therefore, but believe that the ligament aids very materially in rubbing off the rock, or, at all events, in graduating the pressure of the valves during the same process, and that this curious formation, instead of being worn away, may, like the callosity upon a workman's hand, increase in toughness the more labour it is called upon to perform. Still I feel pretty confident, that although the ligament may greatly assist, the *shell*, as I have said before, forms the principal agent in boring the animal's dwelling.

The conclusion I arrive at from these facts, may be thus summed up : That as the *Pholas* only bores the rock in sufficient degree to admit of its increased bulk of body, it only requires to bore occasionally ; that there may be often an interval of many months, during which time nature will have renewed the serrated edges and rough surface of the valves, and thus enabled the creature to renew its wondrous operations.

The probability of the correctness of this idea is further confirmed by the fact, that the *Pholades* are generally found not very far beneath the surface of the rock in which they live. My specimen, too, did not attempt to bore for a period of two months. How long it had been passive hitherto, is known only to Him who watches lovingly alike over this poor bivalve, as over the most exalted of His creatures.

There is a most singular circumstance, which I

must not forget to mention, connected with the Pholades. This is their phosphorescence. “ This property has long been known. It is even mentioned by Pliny. The creature is said to secrete a certain luminiferous fluid, which causes everything on which it falls to shine with a pale phosphorescence. M. De Blainville says, that the Pholades are the most luminous of all molluscous animals; and he even relates, that those who eat the animal raw, in the dark appear, in a most awe-inspiring fashion, to be breathing flames !* This phosphorescent quality is most powerful the fresher the animal is, disappearing if dried, and reviving, it is said, by the addition of a little salt water. The cheering beams of the solar ray cannot light this patient miner to its work, nor penetrate to the confines of its cell; but the Creator has given it ‘a light to its dwelling,’ wholly independent of the great source of light to the world around; and this pale, gentle, lambent flame makes, what otherwise would have been a dismal gloomy cave, a light and cheerful home” (?) “ throughout the long years of the creature’s existence.”

This extract is from an able paper in *Chambers’s Journal*, June 1849. The writer thus concludes his history of the Pholas family:—

“ We have mentioned the Pholades as the enemies of man in some respects” (boring into the foundations of wooden piers, &c.); “ we may, in conclusion, advert

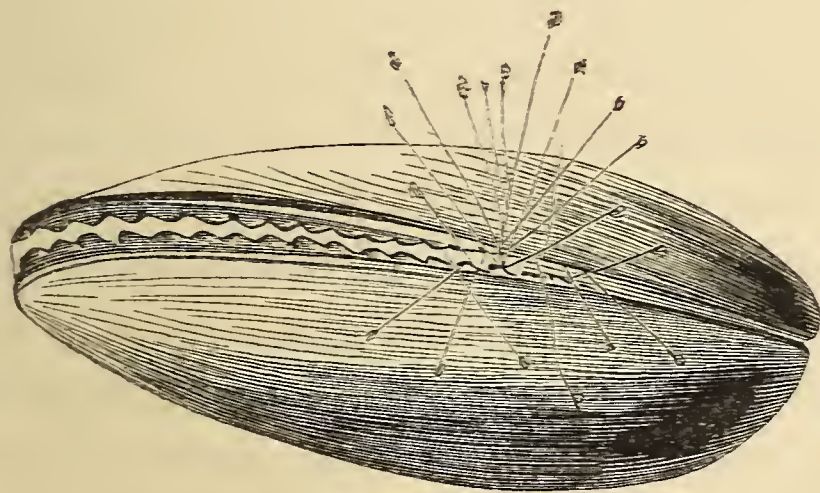
* This peculiarity I have never been able to detect in even the slightest degree.

to a different and more agreeable relation in which they stand towards him. At the tables of some epicures, these creatures are considered as a great delicacy. The Romans, who, as Dr Adam tells us, were particularly fond of shell-fish, bringing them all the way from Britain to the luxurious city, appear to have set an edible value upon the Pholades. M. Desmarest, to the great annoyance of the geologists, has attempted to prove that the celebrated perforations in the temple of Serapis by the Pholades, took place, not in consequence of the subsidence of the land, but of the conversion of the temple and its vicinity into a fish-pond ! And M. De Blainville aggravates them still more, by putting the question ‘whether the Pholades were not put there purposely for the supply of the table?’ At the present day they are largely used as an article of food in France and Italy, and on the coasts of the Mediterranean, where they abound. In the neighbourhood of Dieppe, Mr Stark tells us that bands of women and children, each armed with a pickaxe, make a formidable array against the unhappy Pholades, who tremble in their rock-citadels as these besiegers approach. By means of the sharp point of this implement they are able to detach considerable fragments of the rock, and a rich harvest of the molluscs ensues. They are then sent to market, or, deprived of their shells, are used as bait for other fish.

“That gem-like phrase, ‘sermons in stones,’ to use the words of a living poet, has sparkled so long ‘upon the finger of Time,’ that its brilliance has become

somewhat damaged for our purpose. But if inanimate creation can teach lessons of wisdom to man, few, we think, will be disposed to deny, that a fragment of perforated rock is more forcibly eloquent upon the subject of perseverance under difficulties, than the most nervous appeals to the mind from the pen or lips of any human philosopher.”

The Common Mussel (*Mytilus edulis*) should always have a place in the Aquarium. It is a very hardy creature, and although familiar to every one, is by no means an uninteresting object of contemplation. It especially commands our admiration, whenever, by means of its byssus (formed by a number of silk-like threads), it anchors itself to the sides of the tank, becoming so fixed that it would take pretty considerable force to dislodge it.



COMMON MUSSEL (shewing the Byssus threads).

“The manner in which the byssus is accomplished is as follows: a deep groove runs along the under surface

of the foot, at the bottom of which thin, horny filaments are formed by an exudation of a peculiar substance, that soon hardens and assumes the requisite tenacity and firmness. While still soft, the Mussel by means of its foot applies the extremity of the filament, which is dilated into a kind of little sucker, to the foreign substance whereunto it wishes to adhere, and fastens it securely. Having accomplished this, the foot is retracted, and the thread, of course, being drawn out of the furrow where it was secreted, is added to the bundle of byssus previously existing, all of which owed its origin to a similar process." *

There is another bivalve to be found on our coasts, named Pinna. It has something of the appearance of a monster Mussel.

This animal also spins a byssus, the threads of which are so numerous, soft, and delicate, that they are not unfrequently spun like silk, and manufactured into various small articles of wearing apparel.

Mr Gosse, speaking of the Pinna, says that, "in the British Museum, together with some fine specimens of the shells of this mollusc, there is a pair of gloves made of its byssus; but articles made of this material are very costly, and cannot be considered in any other light than that of curiosities. Pope Benedict XV., in 1754, had a pair of stockings presented to him, which were woven from the silk of the Pinna. These were the subject of general admiration, from the extreme

* Professor Jones's "Animal Kingdom."

delicacy of their texture, well shewn by the minuteness of the box in which they were enclosed.”

When collecting Mussels, you need not be at the trouble either to put them in your bottle, or make for them a sea-grass mattress whereon they may rest, until you return home. They can make themselves equally comfortable lying loose in the basket, or confined in the pocket of your coat.

Being lately at the rocks, with no apparatus for preserving delicate marine specimens, I brought away, for hatching purposes, a cluster of the eggs of *Buccinum undatum*—those white bladdery masses that are so commonly seen attached to the under sides of rocks, &c.—and also a companion cluster of the eggs of the *Purpura*, which are also extremely common. These look like a series of white miniature vases, or urns, of elegant form, fixed by their base to the lower surface of large boulders, or even loose stones. These objects I put in my coat pocket, along with a small Mussel, to which was attached a large frond of the Saw-leaved *Fucus* (*Fucus serratus*).

The egg clusters I duly placed in a small tank, and amused myself by cutting off portions and examining them under the microscope. Being absorbed in this procedure, I forgot to release the Mussel from his prison in the pocket of my paletot. *Four days* after I discovered my omission, and naturally expected that the poor bivalve would be defunct. Such was not the case. His shell was tightly closed, but soon opened again when placed in sea water.

Many readers are probably unacquainted with the great consumption of the Mussel as bait. The following extract may be interesting:—"In Newhaven alone there are four large deep-sea fishing-boats, which generally go out three times a week, and fish for about thirty weeks in the year, excluding Sundays and bad weather. Each of these large boats carries eight men, with eight lines of 800 yards in length, which, at a low calculation, take 1200 mussels to bait each time that they are so used; so that each large boat will use 28,800 mussels per week, equal to 864,000 per annum. But there are about sixteen other smaller boats, which go out daily, or rather at twelve o'clock every night, for about the same number of weeks in the year. Each carries four men, with four lines 800 yards long; their consumption of mussels will come to 3,456,000. The total consumption for bait annually, in Newhaven alone, may be reckoned at 4,320,000. As there are nearly as many used at Musselburgh and Fisherrow, Buckhaven, Elie, Anstruther, Pittenweem, Crail, and other places on the Frith of Forth, we may calculate that thirty or forty millions of mussels are used for bait alone by the fishermen of this district each year. As an article of food, there cannot be used fewer than ten bushels per week in Edinburgh and Leith, say forty weeks in the year; in all 400 bushels annually. Each bushel of mussels, when shelled and freed from all refuse, will probably contain from three to four pints of the animals, or about 900 or 1000, according to size. Taking the

latter number, there will be consumed in Edinburgh and Leith about 400,000 mussels." *

These interesting statistics will be new, I am sure, to many of my readers.

As regards the consumption of the *Mytilus edulis* in Edinburgh and Leith, I believe the number above stated is far over the mark. In fact, since the magistrates of Leith, some years ago, prohibited the use of the Mussel as food, in consequence of several persons becoming ill from eating some which were collected at the docks, there has been a decided prejudice entertained against them.

I may mention, in confirmation of this statement, that at Joppa and Wardie, myriads of Mussels are to be seen, in many places so thickly clustered together that a knife-blade cannot be passed between them; yet there is hardly ever a person seen gathering any for use. Such being the case, it does not seem probable that the poor (who, of course, are the only class that are likely to eat this fish) would buy that article of food, which, if they thought proper, they could gather at no cost.

There is another bivalve which I would strongly recommend to my readers as deserving attention, viz., the Common Cockle (*Cardium edule*). I need hardly say that it is to be found in equal numbers on our shores as the *Mytilus edulis*. The distinguishing feature of this animal is its surprising agility; and, however improbable this character may seem upon

* Dr Knapp, in Forbes and Hanley.

inspection, it is not the less correct. Some writers, however, resting upon hearsay evidence, greatly exaggerate this quality, and state that "the Cockle has been known to leap over the gunwale of a boat," by means of a singular-looking fleshy foot which it protrudes from its shell.

This assertion appears, to my mind, like the story of the Lobster that "has been known to spring to a distance of thirty feet"—a feat that comes up in every new book wherein Crustacea are mentioned, as regularly as the "marvellous hairy-gooseberry" anecdote, that meets our eye once a-year in the newspapers.

If Sir John Falstaff, of veracious memory, had heard these stories, he might well have ejaculated with a gulp, "Lord, Lord! how this world is given to lying!" We may not uncharitably believe that the sailor man had had a "drappie in his e'e," to assist his natural power of vision, when he saw the Lobster perform his unparalleled "spring;" and hence we must excuse his (the sailor's) jump to a wrong conclusion. Or, supposing that he was not "half-seas over," he might have entered three feet, and some wag getting hold of the log-book, slyly added a cypher to the right side of the numeral, and made it wrong.

There can be no doubt, however, that the Cardium does leap, although in a very small way; for although the jolly tar might tell a "fib," Mr Gosse's veracity may surely be relied upon. I will therefore enrich

my pages, by introducing the humorous account which that gentleman gives relative to this matter:—

“Many persons are aware that the Common Cockle can perform gymnastic feats of no mean celebrity; but the evolutions of Signor Tuberculato are worth seeing. Some of the troupe I had put into a pan of sea water, others I had turned out into a dish dry, as knowing that an occasional exposure to the air is a contingency that they are not unused to. By and by, as we were quietly reading, our attention was attracted to the table where the dish was placed, by a rattling uproar, as if flint stones were rolling one over the other about the dish. ‘Oh, look at the Cockles!’ was the exclamation; and they were indeed displaying their agility, and their beauty, too, in a fine style. The valves of the largest were gaping to the extent of three quarters of an inch; but the intermediate space was filled up by the spongy-looking fleshy mantle, of a semi-pellucid orange hue. At one end protruded the syphons, two thick short tubes, soldered, as it were, into one, and enveloped on all sides in a shaggy fringe of *cirri*, or tentacles. The circular orifices of these tubes—small holes perfectly round, with a white border—had a curious appearance, as we looked at the heart-shaped end of the valves; the discharging orifice, however, was but rarely visible, being usually closed, while the other remained constantly open. But these things were what we afterwards saw; for some time we could look at nothing

but the magnificent foot, and the curious manner in which it was used.

“The two lips of the mantle suddenly separate, and gaping widely all along the front, recede nearly to the valves ; while, at the same moment, a huge organ is thrust out, somewhat like a tongue, nearly cylindrical, but a little flattened, and tapering to a point. Its surface is smooth and brilliantly glossy, and its colour a fine scarlet approaching to orange, but a better idea of it than can be conveyed by any description, will be obtained, by supposing it to be made of polished carnelian.

“This beautiful and versatile foot is suddenly thrust out sideways, to the distance of four inches from the shell. Then its point being curved backwards, the animal pushes it strongly against any opposing object, by the resistance of which, the whole animal, shell and all, makes a considerable step forward. If the Cockle were on its native sands, the leaps thus made would, doubtless, be more precise in their direction, and much more effective ; but, cooped up with its fellows in a deep dish, all their herculean efforts availed only to knock the massive shells against the sides, or roll them irregularly over each other.” *

* “Aquarium,” p. 224.

CHAPTER VII.

COMMON SHORE-CRAB, SWIMMING-CRAB, HERMIT-CRAB, ETC.

“ While fast run before us the sandling and plover,
Intent on the crabs and the sand-eels to feed,
Or on a smooth rock, which the tide will soon cover,
To find us a seat that is tap'stried with weed.”

“ And the prawn-catcher wades through the short rippling
waves.”

ANY one visiting the rocks during the summer months, cannot fail to notice, lying in great numbers around, what will at first sight appear to be the remains of deceased Crabs. Should the visitor, impressed with such a belief, capture any of the living specimens that lie at hand, trembling with anxiety at every footfall that breaks upon their sensitive organs of hearing, he will in all probability be not a little surprised to find that, instead of having the usual hard, horny envelopes, their backs are soft and flabby, by no means pleasant to look upon. It will then become evident that the above remains (*exuviae*) had lately belonged, not to dead, but *quick* Crustacea.

The fact of Crabs and such like animals casting their skins, is one of the most remarkable, but at same time least understood wonders in the whole range of natural history. And as not one in a hundred writers has ever seen the marvellous operation, I am sure my readers will be pleased to read the following quotation from a celebrated author, who has devoted much time and labour to this subject, and who, moreover, has been enabled to write from personal observation. Professor Jones, in his "Outlines of the Animal Kingdom," says :—

"From the extreme hardness and unyielding character of the tegumentary skeleton in Crustaceans, a person unacquainted with the history of these animals, would be at a loss to conceive the manner in which their growth could be effected. In insects all increase of size prior to the attainment of the perfect condition, and expansion, is provided for by the moult or changes of skin, which take place during the development of the larva; but the Crustacea, having acquired its mature form, still continues to grow, and that until it acquires in many instances a size far larger than that which any insect is permitted to arrive at.

"The plan adopted in the case before us whereby the growth is permitted, is attended with many extraordinary phenomena. At certain intervals the entire shell is cast off, leaving the body for the time unfettered, indeed, as regards the capability of expansion, but comparatively helpless and impotent, until such

time as a new shell becomes secreted, and by hardening assumes the form and efficiency of its predecessor.

“We are indebted to Réaumur, who watched the process in the Cray-fish (*Astacus flaviatilis*), for what little is known concerning the mode in which the change of shell is effected. In the animal above mentioned, towards the commencement of autumn, the approaching moult is indicated by the retirement of the Cray-fish into some secluded position, where it remains some time without eating. While in this condition, the old shell becomes gradually detached from the surface of the body, and a new soft cuticle is formed underneath it, accurately representing, of course, all the parts of the covering which is to be removed; but as yet little calcareous matter is deposited in the newly-formed integument. The creature now becomes violently agitated, and, by various contortions of its body, seems to be employed in loosening thoroughly every part of its worn-out covering from all connexion with the recently secreted investment; this being accomplished, it remains to extricate itself from its imprisonment—an operation of some difficulty—and when the nature of the armour to be removed is considered, we may well conceive that no little exertion will be required before its completion. As soon as the old case of the cephalo thorax has become quite detached from the cutis, by the interposition of the new-formed epidermic layer, it is thrown off in one piece, after great violent exertion; *the legs are then withdrawn from their cases,*

after much struggling, and, to complete the process, the tail is ultimately, by long-continued efforts, extricated from its calcareous covering, and the entire coat of mail, which previously defended the body, is discarded and left on the sand.

“The phenomena which attend this renovation of the external skeleton are so unimaginable, that it is really extraordinary how little is accurately known concerning the nature of the operation. The first question which presents itself is, How are the limbs liberated from their confinement? for, wonderful as it may appear, the joints even of the massive chelæ of the Lobster do not separate from each other; but, *notwithstanding the great size of some of the segments of the claw, and the slender dimensions of the joints that connect the different pieces, the cast-off skeleton of the limb presents exactly the same appearance as if still encased in the living member.*

“The only way of explaining the circumstance is to suppose that the individual pieces of the skeleton, as well as the soft articulations connecting them, split in a longitudinal direction, and that, after the abstraction of the limb, the fissured parts close again with so much accuracy, that even the traces of the division are imperceptible. But this is not the only part of the process which is calculated to excite our astonishment. The internal calcareous septa, from which the muscles derive their origin, and the tendons whereby they are inserted in the moveable portions of the outer shell, are likewise stated to be found attached to the

exuviæ: even the singular dental apparatus, situated in the stomach, is cast off and reformed; and yet, how is all this accomplished? how do such parts become detached? how are they renewed? We apprehend that more puzzling questions than these can scarcely be propounded to the physiologist; nor could more interesting subjects of inquiry be pointed out to those whose opportunities enable them to prosecute researches connected with their elucidation."

Another curious fact in connexion with these animals must not be omitted. This relates to the power they possess of rejecting an injured limb. Upon the occurrence of such an accident, a new limb is gradually developed, and remains folded up in the old shell, ready to start forth sound and whole at the next moulting-time!

To quote the words of Mr Spence Bates*—"When a limb is injured, all crustacea have the power of rejecting it, except the wound be below the last joint.† This is done by an apparently violent muscular contraction, finishing with a blow from another limb, or against some foreign body. The amputation is the work of a few seconds, except when they have but recently cast the exuviæ, when, during the first few days (before the new skeleton is hardened), they have not that easy capability, and the wounded limb will

* "Mag. Nat. His.," 1851.

† I once cut the hand of a Crab through the joint, so as to remove only the thumb and finger. The limb was not rejected. When the shell was cast, the hand continued maimed, and never was reproduced.

sometimes remain for perhaps half an hour or longer before it is rejected.

“The new limb is formed within the old shell, and lies folded up until the exuviae are shed, when it appears as a part of the new skeleton, the sac-like membrane which protected it being cast with the annual moult, and is larger or smaller in accordance with the length of time which may exist between the period of the amputation of the limb and the shedding of the skin. The condition in which the limb is then remains, as the rest of the animal, stationary in growth, until the next period of shedding the exuviae, when the whole creature again advances in size, but the new limb more rapidly than the remainder of the animal, until it equals it in relative proportion.

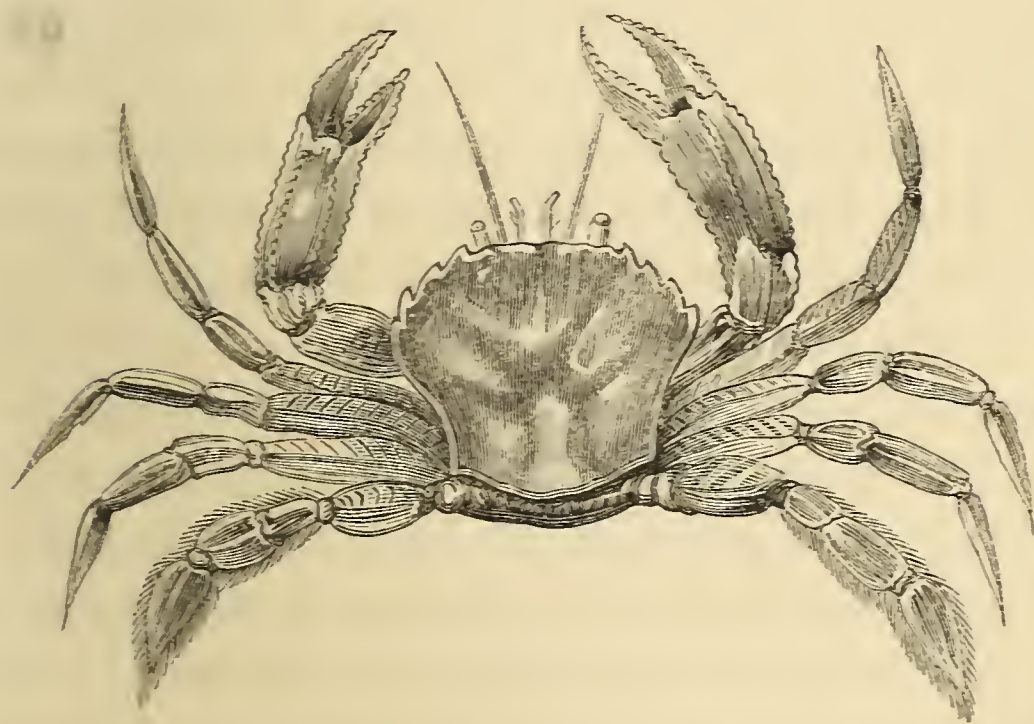
“It is, therefore, dependent upon the length of time which occurs between the accident and the next succeeding moult, to allow the new limb to develop itself, that the variety of size depends, which has given rise to the prevailing idea of the limb itself continuing to enlarge constantly.”

Verily, to contemplate such mysteries as these,

“Imagination wastes its strength in vain,
And fancy tires and turns within itself,
Struck with the amazing depths of Deity.”

When remarking, at the commencement of this chapter, that the skinned Crabs were “unpleasant to look upon,” I alluded not so much to the eatable Crab (*Cancer pagurus*) as to that horrid rascal (*Carcinus maenus*), who seems as if he were always fed on ver-

dant pickles, or copperas, or some other like poisonous substance, that diffused a dark olive, unwholesome green over his complexion. Both species are expert at sidling their bodies into crevices, or hiding under rocks and fuci. Their locomotion is effected entirely by means of taper legs and pointed, toe-like claws. Some of their brethren, however, such as our friend the Fiddler (*Portunus puber*), whose acquaintance the reader has previously made, possess the power of swimming, as well as galloping about like dancers on the tips of their toes. Their hindmost legs appear as if they had passed under a small mangle, having completely lost the claw form, becoming flat and oval at



VELVET FIDDLE -CRAB (*Portunus puber*).

the ends, and ornamented with a hairy fringe. Endowed with these peculiar legs, they flap the water in

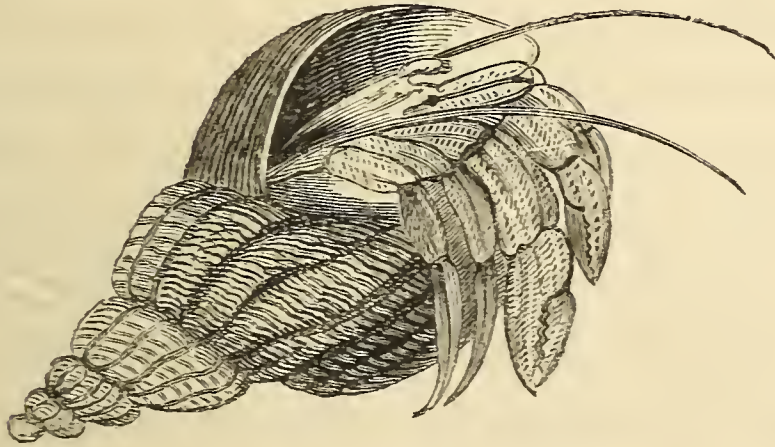
a strange manner, and row their bodies with great velocity through "the briny deep," in company with the upper classes of fish society; while their poor unfortunate brethren, minus the proper qualification, are obliged to mix with common Oysters, houseless molluscs, crustaceous burglars,* and other low society at the bottom of the sea.

There is yet another class of Crabs which we must not forget to mention, for they play a most important part in the economy of the tank. A member of this family, who may be called a crustaceous Diogenes, without the lantern, is generally termed Soldier-crab, from certain pugnacious propensities he is supposed to possess, or Hermit-crab (*Pagurus bernardhus*), from always living in a solitary cell or shell.

Many of the pools at Joppa, and other places on the coast, are studded with these animals. I possess twenty dried specimens of them in their domiciles, of sizes that vary from one quarter of an inch to five inches in length, all taken in less than a single hour. The peculiarity of this Crab is, that in consequence of his tail being soft, he is obliged to protect it artificially. This he does by hooking it on to some turbinated shell, such as Periwinkle, Whelk, &c., &c., whose original inhabitant has disappeared, and in which Mr Bernardus *absquatulates* for a certain time, until, finding his "corporation" increase, he is compelled to go on an excursion in search of a more

* *E. g.*, the Hermit-crab.

commodious lodging. Having found his heart's desire, he proceeds to occupy it *sans ceremonie*, leaving his old casing for some younger and less corpulent brother.



HERMIT-CRAB, in Shell of Large Whelk (*Buccinum Undatum*).

“Why our so-called Hermits are gifted with this singular instinct, is not easy to conjecture. Many other creatures make use of houses they had no hand in erecting, as the bees, the cuckoo, and sometimes the bear, &c.; but I do not recollect any that, as it were, clothe themselves with the cast-off garments of other animals. Providence, besides the defence of their otherwise unprotected bodies, has no doubt some object of importance in view in giving them this instinct. Perhaps they may accelerate the decomposition of the shells they inhabit, and cause them sooner to give way to the action of the atmosphere; and as all exuviæ may be termed nuisances and deformities, giving to these deserted mansions an appearance of renewed life and locomotion, re-

moves them in some sort from the catalogue of blemishes. By this physical hypocrisy of assuming the aspect of a different animal, which is known as not having powerful means of destruction, these creatures may deceive the unwary, and make them their prey, which, if they wore the livery of their own tribe, would be on their guard and escape them.” *

“It is a question of some interest, whether the Hermit-crab always chooses for its habitation a shell already empty, or whether it actually kills and devours the inhabitant of one that suits its size, and then takes possession of its violated home. The latter I believe to be true, in many, if not in most cases; not certainly, however, in all, as we often find the Hermit occupying an old and long-abandoned shell. But so much more generally is it found in fresh shells, that it can scarcely be doubted, even on this ground alone, that it often obtains its habitation by violence. The fishermen on the coast are fully persuaded of this; and an intelligent person of this class at Bognor, assured me that the aggressor seizes its victim—the Whelk, for instance—immediately behind the head, and thus kills or disables it, then eats it, and finally creeps into and appropriates its vacant shell.” †

This statement may be correct, but, so far as I know, it never has been confirmed by the experience of any other author. Whether it is that my own

* Kirby, “Bridg. Treatise.”

† Professor Bell, “Stalk-Eyed Crustacea.”

specimens have been more than usually meek and quiet, I cannot say; but certainly they never shewed any signs of being at all likely to commit such a serious offence as that above laid to their charge. It may be, perhaps, because I always fed them well, and therefore left them no inducement to exhibit any cannibal propensities towards their companions.

It is not incurious to speculate upon the age at which the juvenile Hermit-crab becomes aware that he must shift for himself, and hunt about for a shield to protect him from danger. Do his parents give him his first lessons? or is it instinct? Supposing that no shells were to be found, what would be the result? would nature come to his aid? and what, again, is the largest size to which such creatures grow?

While the Hermit is in good health, he keeps a firm grip of his mansion with his hooky tail; but no sooner does he feel squeamish and poorly, than he loosens his hold and crawls outside the entrance door, there to die. This is invariably the case, and one can hardly conceive a more pitiable object than he presents when in this melancholy condition — so tame, so crest-fallen, so totally the reverse of the usual sharp, snappish, impudent style in which he conducts himself when at home and in good health.

Be careful to nip him out of the tank as speedily as possible after he has given up the—— shell, as his company, at no times over pleasing to his companions, soon becomes a perfect nuisance. His carcase breeds miasma and death to all around.

During life, he is only comfortable when creeping over a flat surface, yet his restless disposition causes him to be ever roving about, making vain endeavours to mount inaccessible crags, or climb to the tops of slender trees, or rocks, or bushy tufts of *Chondus-chrispus*, or any other weed that will sustain his weight. Bumps and falls he does not seem to heed. I have seen one hauling, slipping, and tugging to get to the top of some fronds; and no sooner had he succeeded, than, losing his equilibrium, he toppled down, and rolled over and over without sustaining the slightest injury, or feeling at all alarmed. Indeed, no sooner was his tub steady, than he popped his arms over the smooth edge, and looked up so quaintly, as much as to say, What do you think of that? wasn't it clever?

I watched an individual of this class, that for several days, from what reason I cannot tell, had set his mind upon reaching a cluster of Mussels, that were attached and branching out, self-supporting, from the centre piece of rockwork in my Aquarium. The Crab inhabited an old worn-out *Trochus* shell that had only the last whorl left entire. Altogether his appearance was vulgar and slovenly in the extreme. He had several times tried to climb up the face of the rock, but his shell, like the chain attached to a convict's leg, proved an insuperable barrier to his success. He did, however, eventually succeed in reaching the desired haven, after the following curious way.

There was a large Periwinkle in the tank, who, having taken it into his head to promenade about, came at last sailing under the byssiferous molluscs suspended from the rock, with his horns full set. No sooner did the artful Pagurus observe this, than he immediately popped out from his observatory, and gave, or attempted to give, the aforementioned horns a nip. Whether he really expected to take a piece off them, or whether he knew that the movement would cause the Buckie to make a dead stop, or not, I cannot say ; but certain it is, the latter did actually stop, and just in the very position desired by the cunning Hermit, who quickly mounted on his back, and from thence succeeded in gaining a seat on the Mussel-bed. But as it happens that artful people are frequently caught in their own traps, so it proved to be the case in the present instance. The cunning Crab had forgotten, that in all probability the Periwinkle, after a decent pause, would peep out, and, should he find the road clear, would certainly start off again upon his circumambulations. In the present instance this was exactly the case ; leaving his companion to find out the loss of his footstool when he attempted to descend, and at the same time to discover how he had been tricked by his own want of foresight. When the discovery did take place, Mr Crab's movements were indeed extraordinary. It was impossible to resist a smile at witnessing his despair. He continually ran to and fro—coming very much out of his shell, to take a peep over what

must have seemed to him a steep precipice. Unable to make up his mind to take the desperate leap, or allow himself to topple down, he remained for a whole day in this position, but, pitying his forlorn state, I gently picked him up with a piece of bent whalebone, and let him drop softly upon the pebbly beach below.

On another occasion I possessed a Soldier-crab, that inhabited a *Purpura* shell, which was, however, quite insufficient to conceal him. Whether it was that his tail was weaker than usual, I cannot say, but in spite of my efforts to make him shift his quarters to some more suitable, though more weighty couch, he always preferred his original dwelling. I dropped in for his approval, at different times, at least six turbinated cots, any one of which would have suited him to a turn ; but no, although his head and the greater portion of his body were always exposed, from some unaccountable reason, he always appeared contented and happy with his choice.

By accident did I hit upon a plan to eject him. I had a Dog-whelk, which was at least twice the size of the Hermit-crab, and, as it approximated too closely to the top of the tank to suit my notions of propriety, I gave him a sudden jerk that sent him plump to the bottom. He landed in a corner close to a piece of sandstone, on which some delicate *Ulva latissima* was growing, and luckily, in the same corner the Hermit was seated performing his toilet, little anticipating my disturbance. Meantime Mr Whelk in a few

seconds, not being at all maimed by his fall, prepared as usual to make a move, and gently turning back his horny door, or *operculum*, he affixed his broad breast to the first object within reach, and the aforesaid *Purpura* shell holding this position, *it* of course was selected for the purpose.

Shortly thereafter, the Crab, wishing to take his morning walk, prepared to move. Imagine his surprise and indignation, upon finding that his carriage refused to be drawn after him with its usual facility. He knew that the obstruction could not have arisen from its having stuck in the mud, and therefore probably concluded that I or somebody else (not at all an unusual occurrence) was playing tricks upon him. In this belief he gave a strong pull, and then, finding he did not advance in the least his vehicle from its former position, he popped inside with the intention of tiring us out, and so getting free. Accordingly, after a short interval, thinking perhaps that all was right, he peeped at first rather slyly out, but in a little with great boldness, when, to his horror, what should meet his eye but the monster mollusc bearing down upon him, and threatening to crush himself and his dwelling all to pieces beneath its weight! That he was greatly alarmed was evident—if not from his face, at least judging from his actions, for he pulled and tugged and shook his long antennæ threateningly, although without the slightest success. A pony might as well have attempted to pull a phæton to which was attached a

heavy brewer's dray, as the Crab to move the united weight of his shell and the great Whelk combined. There was one hole left for him, whereby he might creep out of his difficulty. It was not a pleasant alternative certainly, but it must be done, so giving a final tug, quite as futile as any he had before made, he unhooked his tail, and clambered up the friendly piece of sandstone that stood hard by. From the apex of this resting-place he looked savagely down upon the wretch, who had, as he thought, wilfully robbed him of his house—his all !

“Is it not too bad, sir, for such a crawling rascal to *stick* to his neighbour's property like that?” he seemed to ask, looking up at me. “*Honi soit qui mal y pense*,” thought I, for I knew the Whelk had, like Michael Cassio,

“Err'd in ignorance, and not in cunning.”

I could not, therefore, think of going to the rescue. The result proved that it was unnecessary ; for, soon afterwards, he had crept over the Hermit's cell, and was quietly wending his way towards the wrinkled sands.

The Crab, who had been attentively watching every movement, no sooner perceived the coast clear, than he scrambled down to his “old house at home,” before the door of which I had just mischievously pushed a pebble. Determined not to be baffled by such an obstacle, he quickly scraped it away, sorted

his shell, and, giving a kind of gymnastic leap (that made me laugh heartily) from the place where he stood, he dropped his tail with the greatest precision into the aperture, adjusted his body, and galloped off to some more favourable spot.

This little incident taught him a lesson, from which it was evident he profited on another occasion. Indeed, the next day I found he had voluntarily taken up with a shell much better suited to the calibre of his body.

It was very annoying, after I had waited so long and patiently to *see* him “flit” to another residence, to find that he had done it on the sly, and under the shadow of night, like a swindler that had not paid his rent. But many a time have I, in common with other zealous observers, been similarly disappointed. Most animals, especially simple ones such as those of which I write, have a sweet will of their own, and will not be forced, even in the slightest degree, to do what their masters might wish. It is on this account that it is so difficult to treat of their habits from personal observation. It not unfrequently occurs that before a circumstance can be chronicled—which, when written, takes but a few minutes to read—days, weeks, and even months are spent in constant watchings by the anxious student.

I have found, at certain times, on placing several Hermit-crabs in my tank, that they have quickly left their shells and died. Yet, on other occasions, I

have had them live for months. For a long time, I was much puzzled at this. Experience, however, has solved the mystery; and as my young friends may derive benefit from my labours, I shall proceed to enlighten them upon the philosophy of the tank.

I found, then, that if, when I saw the Crab leave its shell, I took it up and placed it in a cup full of water, dipped gently out of the Aquarium, that it generally in a short time revived, and was as lively as ever. Why should it live in one place, and not in the other?—the water was the same. The same in appearance only, but in reality very different; the one being much *salter* than the other, and the animals, being suddenly immersed in a fluid the density of which was so different to what they had been accustomed, could not live in it any length of time; whereas the consistency of the water taken from the upper portion of the tank would perhaps be the same as in their own rock pool.

When so situated, I would advise the young aquarian to syringe the water well; then, while the whole is disturbed, to hold a saucer inverted in his left hand above the tank, and, with a caraffe of *fresh* water in his right, pour about a tumbler over the saucer, or more, according to the size of the Aquarium. When the water is clear again, place in the Soldier-crabs, and they will no longer need to dread their saline enemy; for he, having been subdued by your procedure, will become their best friend, the preserver of their very existence!

A short time since, I placed two Hermit-crabs in a cup, for reasons above stated. One was about an inch and a-half, the other three-quarters of an inch, in length. They both soon seemed to recover their health and spirits. As it is highly amusing to witness a Lobster-crab proceed to occupy a new shell, I placed in the cup a *Purpura*, that had several old Barnacle shells attached parasitically upon it.

The little Crab seemed as lively as a kitten, and about as full of pranks. He very quickly crept inside the shell, and hid himself from view, whether intentionally or not it is impossible for me to say. Immediately afterwards, the large Crab came to the smooth lip of the Whelk, and put in his claw, in the usual style of all members of his family, to see if anything was there to hinder his quiet occupancy of the dwelling. We can fancy how the mischievous little Crab would shrink into the very end whorl as soon as he got a hint of his big brother's procedure. Being satisfied with his survey, the sober Hermit lifted up his soft and beautifully-painted "continuation," and let it drop with a graceful curve inside the aperture, then moved it about to find a proper spot on which to hook it.

Not an instant elapsed before he whipped it out again with the celerity of lightning.

He was in a rage. He had been tricked and insulted, and in his fright perhaps thought he was injured, instead of only being slightly tickled. Revenge was evidently indicated by his excited movements.

Presently the wee practical joker peeped up, doubtless thinking his pranks had been taken in good part. Such was not the case. No sooner did he appear than he was clutched, and, in spite of his puny opposition, a forcible ejection was served upon him, in addition to which he received rather a severe personal chastisement.

The large Crab then quickly seated himself in his testaceous castle, and I have no doubt thought himself at last supremely happy. Alas! nor we, nor peaceful Hermits, like our friend, can make sure of anything for long.

His quiet speedily was disturbed. The infant Pagurus, searching about, found an empty Barnacle shell on the top of the Whelk, and in this he ensconced himself. From his turret he put out his claws and annoyed his brother, by catching hold of his sensitive antennæ, without the latter having any power to punish his troublesome relation, in consequence of not being able to bend his claws over or behind his head.

The only plan would have been for him to come out of his shell, and mount up to where his adversary was so snugly seated; but this he did not seem to think of, but evidently preferred settling despairingly down into the innermost recesses of the *Purpura*, out of reach of petty annoyance.

Next day I dropped into the miniature tank an old Whelk shell, the surface of which had been worn smooth by constant knocking about on the beach.

It was rather a peculiar shell, being nearly full of various sized holes.*

Into this object the large Crab quickly entered and took up his abode. The little fellow being left in his elevated position, soon deserted it, and roamed about in search of food. I took this opportunity of lifting out the original shell, put a little sea-weed in the cup, and left the brothers for the night.

Next day on looking in, I was astonished to find the small Crab in two pieces—its body being broken off at the waist (if I may so term it). The two large claws of the other Crab were wrenched off his body and lying at the bottom of the cup, two of his anterior legs were protruding through holes in the shell, and the poor *Pagurus* himself was quite dead. How this tragic affair happened I am at a loss to conceive.

I could relate many other anecdotes of the Hermit-crabs, did not my limited space forbid me. I may, however, mention that scarcely a day passes in which the strange habits and quaint comicalities of these singular animals do not afford food for the note-book of the student.

In conclusion, I may inform the reader, that there are seven species of Hermit-crabs, but of these, *one* only (*Pagurus bernardhus*) can be called common.

Walking one afternoon on the Musselburgh Sands, I was not a little surprised to find at every footstep

* The shell is before me as I write; it is one inch in length, and contains fifty perforations.

myriads of objects, springing and jumping about in all directions. A sight so different from what I had observed at any other locality, naturally raised my curiosity, and made me anxious to capture a few specimens.

The task was not so easy as I had imagined; I did, however, succeed, and found them to be what are popularly termed "*Sand-hoppers*," a species of Shrimp of a different form to the *Crangon vulgaris*, Sand-raiser, or Common Shrimp, which grows to such a nice, handsome, *eatable* size, and are found in abundance in most rock-pools near low tide, and even along the whole extent of the Portobello Sands.

To oblige a juvenile friend, I turned occasionally during last summer "Shrimper." I had a net made, and not a little mystified the human sand-raisers, by my dredging operations. While wading up to my knees in water, not a few persons stepped down and tried to get a peep into the tin vessel that held my Shrimps. My protégé was, however, generally paddling in too great a depth for any person to get a distinct view. Baffled curiosity would then turn round and respectfully inquire, what it was we were catching? I remember one day upon my naming "Shrimps" to an individual, whom by his accent I knew to be a Londoner, he exclaimed, "What, real live Shrimps? Shrimps good to eat?" "Yes," I replied, "and first-rate ones too." "But you don't mean to say," he continued, "they are as fine as what we get at Greenwich and Gravesend?" "Yes," quite so, said I, "and even

better." "Lor!" he whispered to his companion as they moved away, "I'd no idea there was *sich* a thing to be got here at all." This remark did not surprise me, when I know that local inhabitants are as profoundly ignorant, and, what my English readers will think still more surprising, as heedless of the fact.

I saw one evening while dredging, a lad stooping near the edge of the water with a builder's trowel in his hand. With this instrument, he was rapidly scooping the sand in a semicircle before him, and dexterously catching a large number of Sand-eels, which he popped into a basin as fast as he could pick them up. I had noticed several persons with spades attempt this sport of Eel-catching, but with comparatively poor success. The weapons they employed were too unwieldy to be of efficient service, but the use of the trowel is, I believe, an admirable plan.

The Sand-eels are in great favour among amateur anglers as bait for Pike. I have tried them, and can speak as to their usefulness, the fish snapping at them with great eagerness. I may add, that the lad above mentioned did not apply his haul for bait, but for home consumption; I asked him if they were good flavour when cooked?

"Aye!" said he, "real fine; in fawk, I dinna ken onything half sae guid."

I have tried the Sand-eels many times in the Aquarium, but they have rarely survived beyond a few hours.

Most writers speak about Shrimps being suitable

for the tank, but my experience does not warrant such a statement. I have repeatedly introduced them, but never found them to live beyond two or three days—indeed only a few hours, if the Fiddler was there. No matter how diminutive he, nor how large the poor Shrimp, the Crab always made them “food for worms” in a very short time.

CHAPTER VIII.

SEA-ANEMONES (*Actinice*).

“ Here, too, were living flowers,
Which, like a bud compacted,
Their purple heads contracted,
And now in open blossoms spread,
Stretch’d, like green anthers, many a seeking head.”
SOUTHEY.

“ On descending in a diving-bell to the wreck of the ‘Royal George,’ which foundered at Portsmouth, its deck was found covered with sea mud, and with numerous groups of the Sea-anemones, which, with their colours and extended arms, made the whole surface resemble a pleasing flower-garden.”

THE sea can hardly exhibit, among all its countless and wonderful occupants, any more marvellous and interesting than the Living Flowers, or Sea-anemones. These may be numbered by the thousand, clustering around sea-side rocks and rocky pools, “offering their loveliness to every eye.” While the simplicity and elegance of their form excites the admiration of a child, their extraordinary construction affords matter

of profound contemplation, alike to the naturalist and to the philosopher.

“ We cannot excuse our neglect of them by saying, what is true with respect to not a few of the most interesting objects in nature, that they are too small to be seen without the aid of the microscope; for all *Actiniæ* can be seen by the naked eye, and several of them, when fully expanded, are of considerable magnitude. The very names by which they are commonly known, shew that their beauty has been both seen and appreciated. Even more than a hundred years ago, when little was known of their nature, and when zoophytology was yet in its infancy, before our naturalists had made them an object of study, more common observers had given them appropriate English names. Ellis knew that it would be understood what he meant when he spoke of them as Sea-anemones. He says, ‘ Their tentacles being disposed in regular circles, and tinged with a variety of bright, lively colours, very nearly represent the beautiful petals of some of our most elegantly fringed and radiated flowers, such as the carnation, marigold, and anemone.’ Nay, not only has the resemblance been acknowledged by man, but, in one case at least on record, it forced itself on a connoisseur, who had more practical acquaintance with flowers than any of our florists or botanists. A distinguished naturalist (Mr Couch) mentions, that when he was one day admiring the beauty of a Sea-anemone, as on a sunny day it lay, with fully expanded tentacula, in a

shallow rock-pool, a bee, on honey intent, deceived by appearances, pounced upon the marine flower. The tentacula, being at the very surface of the water, instantly caught the unfortunate intermeddler, and, in spite of its struggles, swallowed it up.”*

The Anemones, perhaps, are the most interesting of all the occupants of the Aquarium. Residents in Edinburgh can easily command a supply. There are three species extremely plentiful at Joppa and all along the Frith of Forth. Many pools are thickly studded with specimens, varying in size from a silver threepenny-piece to a cheese-plate.

The first I shall refer to is the *Bellis*, or Sea-daisy. The members of this class are especial favourites of mine, from their suitableness to the Aquarium. They vary considerably in appearance—some are red, violet, and purple, others nearly white. Some specimens possess tentacles, that in colour and character look, at a little distance, like a mass of brown eider down, spread out in a circular form. A better comparison, perhaps, presents itself in the smallest plumage of a bird, beautifully stippled, and radiating from a centre. This centre is the mouth of the animal, and is of a light yellow colour.

From its corners there branch out a pair of yellowish white horns, that taper to very delicate points, and are oftentimes gracefully curled like Ionic volutes, or rather like the tendrils of a vine.

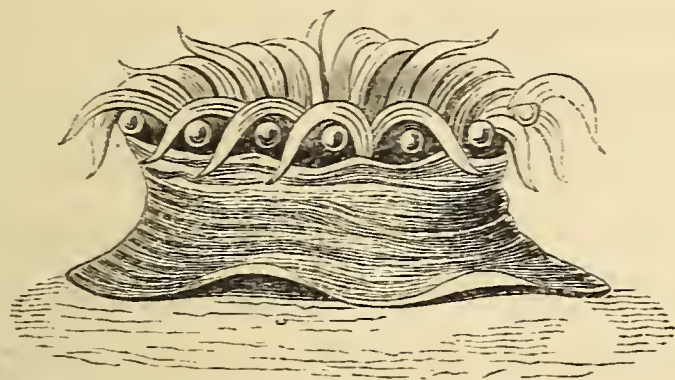
The appearance presented by half a dozen of these

* Dr Landsborough's "Brit. Zoophytes."

creatures in a tank is extremely picturesque, especially to persons unacquainted with them. It is difficult to convince such that those pretty flower-like objects are possessed of life, or that they can exhibit such marks of volition, as when touched either to disappear altogether in the sand, or to present only a small unsightly knob of dirty white jelly. They are so hardy, that having once affixed themselves, and become attached to their new home, they will bloom and excite your admiration many months throughout winter or summer. I remember two that remained alive at the bottom of the tank, after I had emptied it of all its contents, and washed it thoroughly with *fresh* water, which is generally supposed to act as a poison upon them.

The members of the next species, which has the disadvantage of possessing a very long name, *Actinia mesembryanthemum* (in colloquial parlance abbreviated to "Mess"), or Smooth-anemone, are very numerous, and may be found pendant from the under parts of rocks, situated at, or even beyond, the highest tide-mark. They are in consequence very hardy, and well adapted to flourish in an Aquarium; but they are unfortunately, in every respect, inferior in beauty and effect to their little sister Daisies. They possess, however, one pleasant feature peculiar to themselves, namely, a string of gems always attached to their necks. These gems exactly resemble in shape and colour the blue turquoise, and when contrasted to the creature's tawny skin, have a charming appear-

ance. These ornaments are not unfrequently obscured by a profusion of tentacles, and can only be discerned by close inspection.



ACTINIA MESEMBRYANTHEMUM.

The last, but certainly not least in importance, is named *Bunodes crassicornis* (or "Crass" for shortness), commonly Thick-horned-anemone. It varies so much in appearance, that two are seldom found exactly alike. It is rather a delicate animal, and never appears to thrive in the confinement of an Aquarium for any length of time. Such at least has been my experience, and I have had a great many, though I never kept more than one or two at a time. All have, after a month or so, become sickly and died.

The extraordinary manner in which they continually change their form, has been made the subject of discussion by many writers, and is, indeed, a circumstance well calculated to inspire curiosity.

The last "Crass" that I adopted far surpassed any which I had seen before as a contortionist, and furnished me with no fewer than twelve drawings, some

of which are truly amusing, considering the form and configuration of the animal in its natural state.

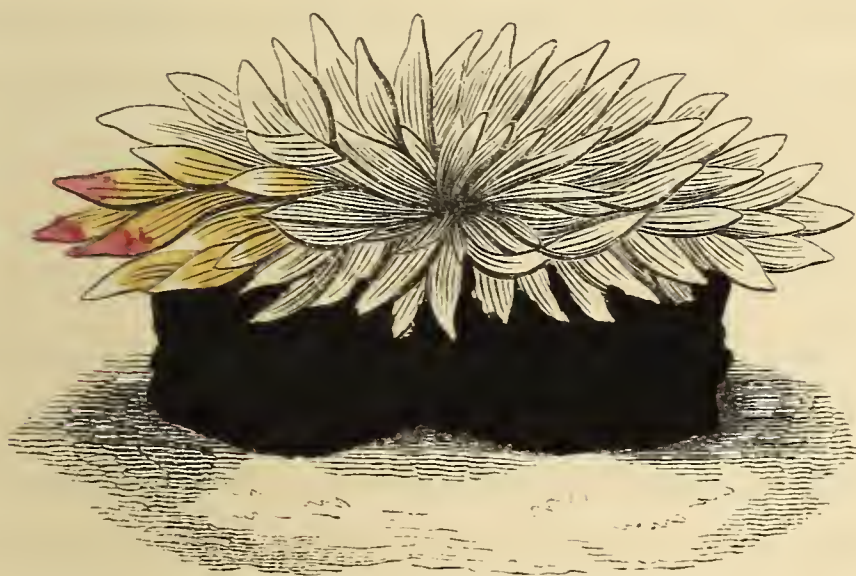
I must give a sketch of this curious Anemone. The first announcement that I received of his having commenced his performances, was from a servant (who had privately taken an interest in the "Quarium," as she called it, and endeavoured to catch up the names of its inhabitants) poking her head within the door of my sanctum, and crying out, "O! pleassir, do come and look, the *enemy* (meaning the Anemone) is a turning hisself inside out! I didn't touch him, sir, indeed I didn't!"

I discovered, however, that from a natural enough curiosity she *had* touched the "enemy" the preceding day—a liberty he immediately resented by losing no time in, to her great alarm and surprise, "turning hisself" outside in!

For a whole week the animal continued his manœuvres, until he finally detached his base from the rock. After this, he rolled about in a most inflated, dropsical condition, being at least three times his usual size. For a time, uncertain what treatment to adopt, it occurred to me that if the water were well ærated, it might do him good. I accordingly took the syringe, and forced several jets of the briny fluid over his body. This, of course, caused a disturbance of the sand and weed, producing myriads of bubbles in the water, and finally making it quite opaque. Upon becoming clear again, I looked to see what effect my doctoring had had upon the patient. To my intense

astonishment, I found that he had disappeared, there being nothing left of him but a mass of jelly the size of a plum.

A *post-mortem* examination of so shrivelled a carcase not satisfactorily aiding my diagnosis of the deceased's ailment, I was left very much in the dark regarding its nature. I incline to believe that the skin had become so much extended as to be of the fineness of tissue paper, and that, under such circumstances, the slightest pressure of water punctured it and caused a collapse, from which the "Crass" did not recover. At all events, he was quite dead when I lifted him out of the tank.



ACTINIA—BUNODES CRASSICORNIS.

Since writing the above, I have met with the following remarks of Professor Rymer Jones. This author observes:—

“The Actiniæ, like the Hydra, possess the power

of changing their position. They elongate their bodies, and remaining fixed at the base, stretch from side to side as if searching for food at a distance. They can even change their place by gliding upon the disc which supports them; or detaching themselves entirely and swelling themselves with water, they become nearly of the same specific gravity as the element which they inhabit, and the least agitation is sufficient to drive them elsewhere. When they wish to fix themselves, they expel the water from their distended body, and sinking to the bottom, attach themselves again by the disc at their base, which forms a powerful sucker."

With all due deference to so respectable an authority, I think the assertion regarding these creatures detaching themselves for the purpose of being thrown or blown about into some new locality, is incorrect. My doubts are due to the following causes:—

1st, That upon no occasion have I ever seen an *Actinia* so detached, and rolling about in any rock-pool. I have had opportunities, during various seasons of the year, of viewing some thousands of these animals; and had such been their usual habit, I am surely justified in expecting that I should have met with at least a solitary instance.

2dly, I have watched them often, especially the *Mesembryanthemum*, creeping along the base and upon the sides of the tank, apparently enjoying a pleasant ramble, the body not being at all disturbed.

And 3dly, I have had specimens of the "Crass"

which remained for weeks fully and naturally expanded; then, from some unknown cause, they seemed suddenly to assume a sickly hue, their lips became discoloured, and a thin, white, fibrous membrane would issue from their mouth. The creature would undergo an almost endless variety of metamorphoses, becoming at every stage weaker and weaker, and finally losing its muscular power, get detached from its resting-place, "so that the least agitation would be sufficient to drive it elsewhere," without, I believe, any power of again affixing itself when drifted to another spot. It then very soon collapsed and died; at least I have observed in several instances this to be the result.

There is besides a fourth species that I must not omit to mention, viz. the *Actinia coriacea*. It is much like the *Crassicornis*, but not so brightly coloured, and is, moreover, tougher in its nature. Dr Landborough thus writes of it:—

"It is about two inches in diameter at the base, variously coloured, often reddish, blotched with green, covered with many pale, perforated warts. The tentacula are numerous in three or four series. It attaches itself to sand-covered rocks, and is often pretty much buried in sand, so as to be partly concealed when in a contracted state. Its warts stand it in good stead; for they have the power of causing to adhere to them sand and gravel, and fragments of shells, so that the body is quite covered. This, it is probable, answers a double purpose. By this covering the animal,

when left by the tide naked, is defended from the scorching beams of the sun. It answers nobly also the purpose of concealment; that kind Providence which cares for the inferior animals, furnishing various means of eluding their enemies. The ptarmigan, which inhabits the lofty mountains, gets white plumage when winters returns, so that even the keen-eyed eagle can scarcely distinguish it from the snow-clad peaks among which it dwells. Were the Alpine hare to be white in summer, it would be too conspicuous when skipping along the heath; and it would be not less so in winter, when all is white around, were its fur not to lose its summer hue, and to become white as the mountain snow. Nothing could be better fitted to conceal this Actinia, which abounds on our shores, than this very covering, with which it knows so well how to clothe itself. When the ebbing tide leaves the sand-covered rocks dry, a Sea-anemone of so large a size, even when contracted, would be very observable. But when the tentacula are all retracted, and the warty skin covered with the sand and shelly fragments that so firmly adhere to it, it is so like everything around, that it is very difficult to detect it—so much so, that very often I have not had the slightest suspicion of an Actinia being at hand till, by some accidental pressure, the water squirted up through its warts and tentacles. When the tide returns, however, the Anemone unfolds itself in beauty, and a marine flower is immediately seen where there was nothing but sterility before. The

tentacula are shorter than the body, and are annulated or variegated with white or red."*

I must not conclude this chapter without cautioning the young zoologist that, while collecting *Actiniæ*, great care should be taken in detaching them from their position. If possible, it is by far the better plan not to disturb them, but to transport them to the Aquarium on the piece of rock or other substance to which they are affixed. This can in general be accomplished by a smart stroke of the chisel and hammer. Should the attempt fail, an endeavour should be made to insinuate the finger nails under the base, and so to detach them uninjured. This operation is a delicate one, requiring practice, much patience, and no little skill. We are told by one author that a slight tear is of no consequence, since the animal is represented as having the power of soon darning it up. It may be so, but, for my part, I am inclined to be sceptical on the point.

I never attempt to capture a Daisy-anemone, unless I first see it fully expanded before commencing operations. I am able, in consequence, to form a pretty probable accurate estimate of its appearance in the Aquarium.

This condition of its being seen, necessitates, of course, its being covered with water, and, consequently, increases the difficulty of making it captive, especially when the animal happens to be seated on a combination of stone and solid rock, or in a crevice,

“His. Brit. Zoophytes,” page 250.

or in a detestably muddy pool, which, when disturbed, seems as if it would never come clear again.

It is, in consequence, advisable to search for those situated in shallow water, the bottom of which is covered with clean sand. When such a favourable spot is found, take hammer and chisel, and commence operations. Several strokes may be given before any alarm is caused to the Anemone, provided it is not actually touched. No sooner, however, does it feel a palpable vibration, and suspect the object of such disturbance, than, spouting up a stream of water, it infolds its blossom, and shrinks to the smallest possible compass. At the same time it tightens its hold of the rock, and is, indeed, often enabled successfully to defy the utmost efforts to dislodge it.

After a little experience, the zoologist will be able to guess whether he is likely to succeed in getting his prize perfect and entire: if not, let me beg of him not to persevere, but immediately to try some other place, and hope for better fortune.

The last-mentioned class of Anemones is certainly the most difficult to be captured, from the great length to which they are enabled to elongate their bodies, and thereby fixing themselves to the base of empty Pholas' holes. On the top of such a spot they frequently display their plumes, or perhaps they select a stone buried four or five inches below the surface of the sand.

I remember on one occasion to have seen a beautiful specimen, which I endeavoured to grasp. It, of

course, instantly closed its tentacles, and, as the water was somewhat opaque, I could not observe what I was doing. But, pushing down my hand, I clutched as large a portion of sand as possible, exactly over the spot where I had noticed the creature disappear. I then drew my fingers and thumb together, expecting to feel the shrinking object of my search, but only felt what appeared to be a slimy annelid. I have a peculiar instinctive antipathy to worms, and therefore instantly drew up my hand, when, to my surprise, I found it held the bulb of the pretty *Bellis*. What I thought was a worm was only the drawn-out body of the fair *Daisy*.

There is no necessity for specially feeding these animals, at all events not oftener than once a month. Some writers assert that a single meal in twelve months is sufficient; yet they are very greedy creatures, and will devour any kind of fish—shell or otherwise—that comes within their reach. The last “*Crass*” that I captured had swallowed a Crab* of so large a size, that its tentacula could not meet, when contracted over the poor victim.

The Anemones, moreover, possess the power of ejecting a poisonous secretion, that has the effect of speedily paralysing any animal that comes in contact with them, and even imparts to man a sensation of

* I am really at a loss to conjecture why Mr Lewes, in his recent “*Sea-side Studies*,” would venture to assert that Anemones never devour Crabs. I have repeatedly seen illustrations of the fact.

burning or smarting. This peculiarity did not escape the notice of Pliny, who says, "It is just like that produced by the nettle found on land." The classical naturalist rather exaggerates the effect. At least, in any that I have experimented upon, the urticating power has been much less severe.

Miss Pratt mentions that the poison is not equal in all the species. In some, she says, "it is sufficient to cause only a slight sensation of tingling in the fingers which have touched the Anemone; in others the sensation is more of a smarting or burning nature." But what is very curious, this author mentions that different persons are variously affected by the touching of the same individual, and gives an instance which occurred under her own observation. Miss Pratt "had placed in a vessel of sea water a fine specimen of the Fig-marigold Sea-anemone (a *Mesembryanthemum*), which she was accustomed to touch many times during the day. Her surprise was great on finding that the same Anemone, on being touched by another person, communicated a more powerful sensation, which her friend assured her, was felt up the whole of the arm. More than twenty persons touched this Anemone, and the writer was amused by observing how variously they were affected; some being only slightly tingled, while others started back as if stung by a nettle."

Chacun a son gout; but certainly, although I admire exceedingly the pretty Anemones, I should not care much to eat one. Indeed, when seeing them

closed, covered with sand and mud, it is hardly possible to conceive any objects more repulsive as an article of food. Yet "in tropical countries they are much used for this purpose; and a beautiful species, with crimson tentacles, which is abundant on the shores of the Mediterranean, is a favourite dish of Italian epicures. Our common Purple Sea-anemone (or *Crassicornis*) is said by the Abbé Dicquemare to be preferable to any other for table. "Being boiled in sea water," says this writer, "these polypes acquire a firm and palatable consistence, and then may be eaten with any kind of sauce. They are of an inviting appearance, of a light, shivering texture, and of a soft white and reddish hue. Their smell is not unlike that of a warm Crab or Lobster." Eugh! I shudder to think of having such "a dainty dish" set before me, and being compelled to partake of it! Ah! if the good Abbé had known anything of Fignon Haddocks or Kippered Herrings, he would not have written thus. At all events, I agree with the excellent Dr Landsborough, that, while we can get such fish as these out of the sea, we shall willingly let the most tempting of our *Actiniæ* bloom unscathed in all their beauty.

CHAPTER IX.

SERPULA, SABELLA, CHITON, DORIS, AND EOLIS.

“Figured by hand divine, there’s not a gem
Wrought by man’s hand to be compared with them.”

“*Do not despise the creatures because they are minute.* No doubt we should both of us prefer helping Rajah Brooke to discover monstrous Apes in the tropical forests of Borneo, or stumbling with Hooker upon herds of gigantic ‘Ammon Sheep’ amid the Rhododendron thickets of the Himalaya, but it cannot be; and ‘he is a fool,’ says old Hesiod, ‘who knows not how much better half is than whole.’ Let us be content with what is within our reach, and *doubt not that in these tiny creatures are mysteries more than we shall fathom.*”—REV. C. KINGSLEY.

ON peering into any rock-pool, the young zoologist cannot fail to perceive, attached to various pieces of rock, broken crockery, loose shells or stones, clusters of certain white twisted tubes, that resemble nothing in the world so much as minute rams’ horns, or calcareous serpents, strangely intertwined with each other. Each of these tubes is inhabited by a species of marine annelid, or worm, called *Serpula*. This curious animal, having once attached itself to any

object, has no power ever after to change its position. Its stony sheath is formed by itself—

“From its own essence exquisitely modell’d,”
and in this it lives throughout its existence.

One species (*Serpula contortuplicata*) affects a stately pride, refusing to mix much in fish society. Its members hold their heads higher than their neighbours, and live and die in solitary grandeur.

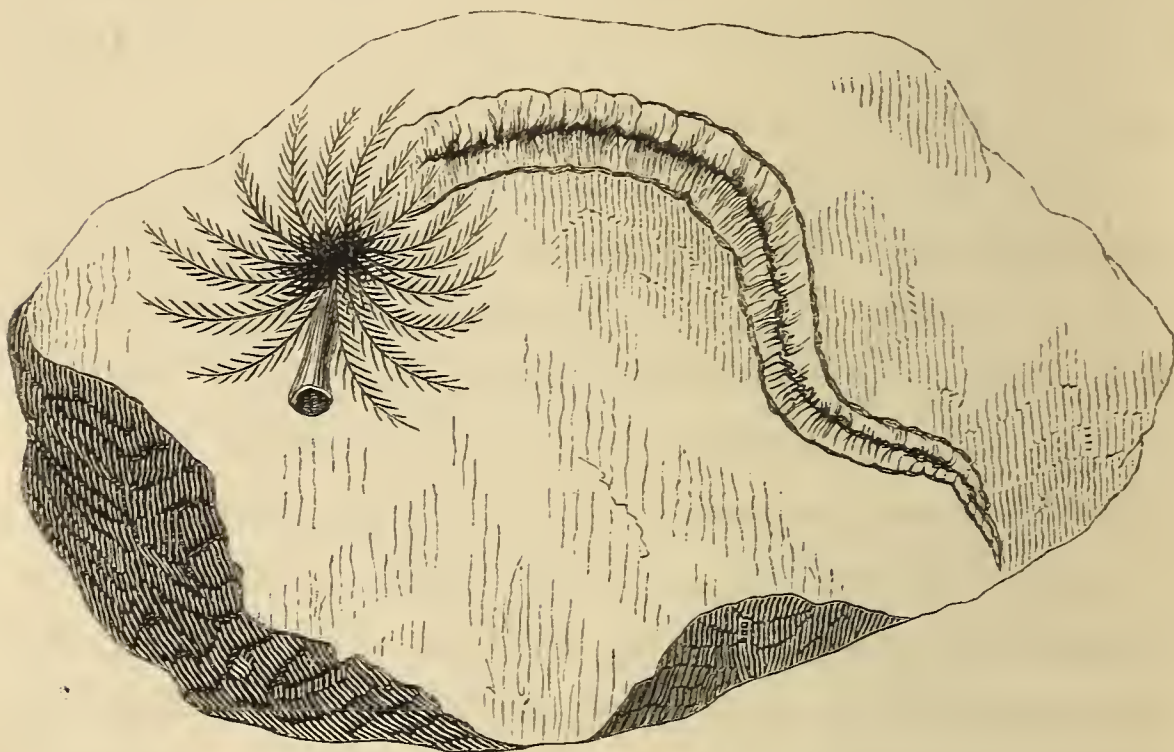
These generally select an Oyster or Scallop for a resting-place, a single *Serpula* occupying a shell or valve to itself. The tube of this class being attached at the base, springs upwards to a height of several inches, whereas the tube of the other (*Serpula vermicularis*), above mentioned, is always prostrate.

I am fond of having at all times some of these extraordinary creatures in the tank, were it to serve no other purpose than to amuse my juvenile friends. Young people take no small delight in getting a peep at the peculiar revelations of marine life, afforded by the hand-lens.

The appearance of the *Serpula* when out of the water is by no means prepossessing, but no sooner is it placed in water, and allowed to remain there for a short time, than it presents a good opportunity for examining its curious structure, more particularly that portion—the breathing apparatus—which it usually exhibits in its native haunts. This consists of a very curious and brilliant plume of feathers, exquisitely coloured with red or violet, which the animal protrudes from the mouth of its shell and

spreads open like a fan. In the centre a kind of conical plug or stopper appears, around which the feathers seem to have been rolled.

The sense of vision which the *Serpula* possesses is



COMMON SERPULA.

extremely acute, and this is the more curious from the fact that all naturalists have hitherto failed to discover any eyes.* Still, that these organs exist, is manifested by, among other proofs, the fact that if a hand be passed over the tank, the fan instantly disappears. After a while, this extreme sensibility, however, becomes dulled by familiarity with shadows cast by passing objects, such as Blennies, &c.

* M. A. Quatrefages thinks he has discovered eyes upon the branchiæ of the *Sabellæ*.—*Vide* “*Mag. Nat. Hist.*,” 1850.

The sketch exhibits one of these creatures reclining on a piece of rock. It is drawn from nature, but appears somewhat different from the usual representations, in respect that the fan seems to open from a double centre, and that the stopper is *under* the expanded plume. It struck me as being rather a surprising fact, that from the centre of the stopper, there sprung a small frond of dulse. How this managed to become attached to such an extremely sensitive organ, I am at a loss to imagine.

There is another class of annelids, nearly allied to the above, named *Sabellæ*.

Their tubes are formed of sand, and are found generally congregated around the edges of the rock-pools, among the weeds. It is easy to detect their presence from the number of holes that appear to have been newly bored, as if with a small brad-awl. They are by no means suitable objects for an Aquarium, as they do not live long in confinement.

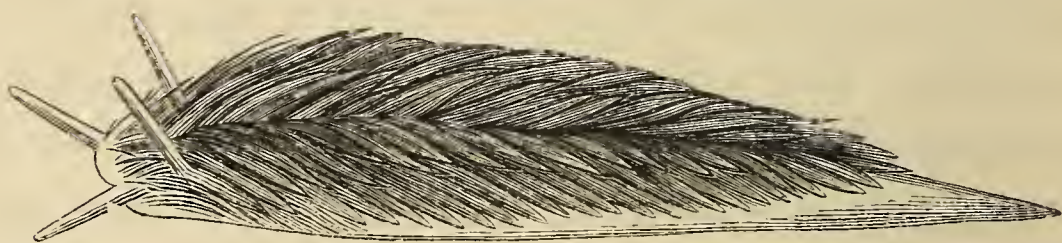
On turning over almost any piece of stone, such as those to which the *Serpula* affixes its tubes, a strange creature, something like a Wood-louse, will often be met with. This animal, which is known as *Chiton*, is not very pretty to look at; and I merely mention it here, because it is common, and because it holds a singular position in the marine animal kingdom. While the majority of its brethren, such as the *Patellæ*, &c., have their bodies protected by a testaceous shield, the covering of the *Chiton* consists of eight shelly plates, or scales, that overlap each other like slates on

the roof of a house, or like the mail plates on some knightly gauntlet.

It generally measures from half to three quarters of an inch in length, although on foreign shores it attains a much greater size. A specimen now before me is exactly two inches long. The colour of this animal is dark brown. Its mode of locomotion, and general character, are precisely the same as those of the Limpet.

Such animals as the Chiton, Limpet, and others resembling them, belong to a species of molluscs called *Gasteropoda*, which are so named from their locomotive organs being attached to the under part of their bodies. They are, however, to a certain extent, armed against attack or danger by a shelly covering.

There is another class of molluscs that creep about without any such protection, and whose gills or lungs, instead of being inside, are exposed on the exterior of their bodies. These are hence called *Nudibranchs*, or Naked-gilled Molluscs. The *Doris* and *Eolis* are



THE EOLIS.

types of this class. The gills of the former are spread out in an arborescent form, and have a most elegant

effect. The latter has these organs branching out over its entire body like semi-transparent quills, giving a most remarkable appearance to the animal as it glides along. Both are to be found adherent to the under surface of stones, &c.

The writer had always been led to believe that these animals were very voracious, and, indeed, that "a wolf would be about as appropriate an inmate of a sheep-fold, as one of them in an Aquarium where Sea-anemones live." Naturally, in consequence of this sweeping assertion against the beautiful Eolis, he watched his specimen with considerable attention for several weeks, and came to the conclusion that he had been shamefully libelled by sundry writers. But that this opinion on his part was premature, he one day discovered. Happening to give my usual peep into the tank before going to bed, I saw plainly that my Eolis "was no better than he should be," and that the charge of greed brought against him was perfectly correct. I was therefore obliged to come to the conclusion that his quiet, sedate manner, was merely assumed for my deception. During the dusk of evening, the little fellow had crept to the neighbourhood of a sweet purple *Bellis*, that sat flowering on a grassy bank. Upon my first discovering him, he had just reached the object of his attack. The plan of his operation was rather remarkable. It seemed as if he possessed the power of fascinating his victim by a basilisk glance; for if I touched the little Daisy, though ever so slightly, it would close

its hands quickly over its breast, shrinking, like the sensitive plant, in evident alarm. But now, this dandified mollusc, with his milk-white coat and purple-tipped streamers waving therefrom, not only touched my pet, but insidiously crawled about, and by slow degrees detached it entire from the disc, the tentacles not being in the slightest degree contracted during the whole of the manœuvre. When this was done, he dragged down the unsuspecting creature, and, serpent-like, crept forward until he reached her pretty golden lips. Then, and then only, did she infold her blossom, and,

“ Like a lily drooping,
Bow her head and die.”

Next morning, having despatched his meal, the Eolis appeared highly delighted with himself; and to shew that his gormandising had had no bad effect upon his usual graceful gait, but on the contrary had rather exhilarated his spirits, he marched prettily up the sides of the tank. Thereafter, to my great astonishment, he walked on the surface of the water, like a fly upon the ceiling of a room, *head downwards!*

Such an occurrence is by no means unusual with this class of animals; but it struck me at the time as being very curious, as I had not had any opportunity of witnessing it before. I have often done so since.

Mr Gosse, in his “Natural History of Mollusca,” explains the operation thus:—

“Many of the aquatic members of this class (*Gasteropoda*) are able to float at the surface, by means of their broad expanded muscular disc or foot. They crawl to the top of the water, up the stems of a plant or the side of a rock, and stretching out the bottom of the foot along the surface, the back being downwards, it presently dries by contact with the air; while it remains dry, it will float the animal, which then glides along as if on a solid body, *crawling, in fact, on the inferior surface of the air*; but, if by any agitation of the water, or by the will of the animal, the foot become overflowed, the state of suspension is ended, and the creature falls to the bottom.”

My first experiment led me to a very different conclusion. Before meeting with the above passage, I had written as follows:—

The Eolis, I believe, swims on the surface of the water by a very simple process, viz., by ejecting a thick transparent slime, which floats on and partly blends with the water. To this gelatinous substance the animal attaches itself, and so becomes perfectly buoyant, roaming about wherever its will directs.

The truth of this statement can easily be tested. Take up an Eolis, lay it gently on the surface of the water, try by every means in your power to make it stick there. The result will be a failure, for the creature will assuredly sink to the bottom whenever you release your hold. But, supposing it has thought proper to climb the sides of the tank, and crawl on the face of the fluid contained therein, take a piece of

stick, push the creature, endeavour to make it sink, and you will find it more difficult than you would at first imagine. When the experiment is successful, the animal, not caring for such treatment, will in time permit you. You will perceive that it does not drop down at once, even when entirely covered by the water, but first its head, then its body sinks. At last, you will see the whole creature suspended by the tip of its tail (?), after which it falls softly to the base of the vessel.

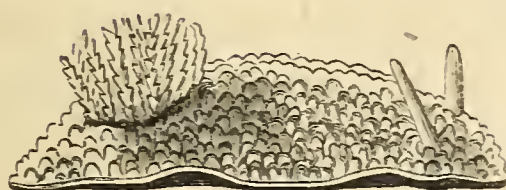
After this, in lifting up some of the water at that part to which the Eolis was attached, you will find it does not fall from your stick in drops, but clings to it like fluid jelly—a circumstance that naturally suggests the idea, that by its adhesion to the gelatinous mass, the animal owes its power of floating on the surface of the water.

A friend who witnessed along with me the appearance which I have just explained in a somewhat feasible way, exclaimed, “That is wonderful, truly!” I thought so too. It is equally wonderful to think, that although I have tried the same experiment again and again, scores of times, it has always failed.

I therefore conclude that the learned naturalist, Mr Gosse, is in the right. I have, however, given my own early notion, in order that it may serve as a caution to the young student in coming to a hurried conclusion upon any matters relative to the mysteries of nature.

The Doris is generally about one inch in length.

It is sometimes of a pale yellow, and sometimes milky-white.



THE DORIS.

There is another species which grows to a large size ; this is commonly called the Sea-lemon, from some fancied resemblance to that fruit when cut in half lengthways. Its technical name is *D. tuberculata*.

I captured one of these animals at Joppa that measured nearly five inches in length. It was of a cream colour, almost approaching to a white, while on several parts of its body were patches of the most brilliant purple, and also numerous tubercles.

I tried to preserve it by dipping it in fresh water, but it emitted such a quantity of mucus, even after I had the trouble of changing the water four or five times, that I felt so disgusted as to throw it out of the window.

The Eolis is a more difficult object for the unpractised eye to discover than the Doris ; and even those familiar with its likeness, would fail to recognise in the strange mass before them the beauteous Nudi-branch of the picture-books.

And yet it is only by illustrations and written

descriptions that the majority of people can know anything of these animals. “ Having no shells, they present no monuments of their existence to the cabinets of collectors; and it generally happens that *our interest is not so much excited by objects that we read of in books, even if pictured in true colours on the plates, as by those which we can see and feel.*”

I beg the reader to weigh well in his mind this remark by Mr Sowerby, for in it we have one of the most pleasing arguments that can be offered in favour of the utility of the Marine Aquaria.

CHAPTER X.

ON SEA-WEEDS (*Marine Algæ*).

“ The timid girls
 Dip the small foot in the retarded brine,
 And search for crimson weeds, which spreading flow,
 Or lie like pictures on the sand below,
 With all those bright red pebbles that the sun,
 Through the small waves, so softly shines upon.”

 CRABBE.

“ Call us not weeds, we are flowers of the sea.
 For lively, and bright, and gay tinted are we,
 And quite independent of culture or showers ;
 Then call us not weeds, we are ocean’s gay flowers.

“ Not nursed like the plants of the summer parterre,
 Where gales are but sighs of the evening air,
 Our exquisite, fragile, and delicate forms
 Are nursed by the ocean, and rocked by the storms.”

ANON.

It is not my intention in this chapter to attempt an elaborate sketch of *Marine Algæ*. My aim is merely to endeavour to make the uninitiated reader acquainted with the most remarkable varieties of Sea-weeds that are to be met with among rocks and rock pools; and

more especially such as it is necessary to introduce into a good Aquarium. The Algæ not only add to its picturesqueness and beauty, but their presence is absolutely essential for the existence and health of its occupants.

This combination which we urge, of sea-weed and sea animals in the Aquarium, is just following out the laws of Nature, as apparent to all who will watch an ocean in miniature at the sea-side. There the most inattentive observer cannot fail to perceive that wherever living creatures are found, there are also plants and sea-weeds of various kinds growing in luxurious profusion, "the one being essential to the other in supporting the life of both."

"The animal and vegetable respirations *counter-balance each other*, the animal's blood being purified by the oxygen given off by the plants—the plants fed by the carbonic acid breathed by the animals." When your Aquarium has been established a short time, if all goes well, you will perceive "thousands of tiny globules (like quicksilver balls of various sizes) forming on every plant, and over all the stones where the infant vegetation is beginning to grow, and these globules presently rise in rapid succession to the surface all over the vessel. This process goes on, without intermission, so long as the rays of the sun are uninterrupted. These bubbles consist of pure oxygen given out by the plants, under the influence of light, and to this oxygen the animals in the tank owe their life." *

* *Vide* Gosse's "Aquarium."

It is therefore of the utmost importance that we should select those Algæ which have been ascertained to possess the property of generating this elixir of life in the greatest degree. Of this class, none are so noted as the *Ulva latissima*—a plant that belongs to the Chlorosperm or Green-seeded Algæ. It is variously termed Green-sloke, Green-laver, and again, Sea-lettuce. It grows in great profusion upon the sea-shore near Edinburgh.

Like so many others of the most common natural productions, it is also one of the handsomest. Indeed, it is almost impossible to mistake it, from its being the only one of a green colour that possesses such large delicate leaves or fronds—

“ Like streamers wide outflowing,”

soft and shining as satin, or the finest gold-beater's skin. Its edges are much *crimped*, but it is to these convoluted folds that it owes its chief beauty.

It is best to chip off a piece of rock to which this weed is attached, and which may serve as an anchor to fix the specimen in any locality that you may desire.

“ I have in my Aquarium ” (says the Rev. Mr Wood) “ a large plant of this species, which generally lives very contentedly in the place where it had been deposited. But a few days ago, the sun shone brightly enough to pierce through the veil of smoke with which the metropolis is generally hidden from his presence, and consequently there was a greater abundance of

light than usual. On looking at the Aquarium, I found that the *Ulva* had risen in the water, and was hanging in most elegant festoons from the surface, forming emerald caves and grottoes, such as a sea-nymph would love. Even at a little distance it was a pretty sight, but a closer inspection revealed still more beauties; for, being excited by the unwonted light, the plant had poured forth so much oxygen, that its entire surface was thickly studded with tiny sparkling beads, that had buoyed up the whole plant, each bubble acting as a miniature balloon. When, however, a black cloud came over the sun, the bubbles soon detached themselves, ascended to the surface, and as there was no more to take their place, down dropped the plant to the bottom."

Totally opposite in character to the *Ulva* above mentioned is the *Enteromorpha compressa*, or Sea-grass, which is also extremely useful, especially in forming a kind of close thicket at the bottom of the tank. In it the fishes are very fond of wandering, either for enjoyment or protection from the glaring heat of the sun. This sea-plant grows in great abundance upon rocks. Their surface is, in many places, completely covered with its verdure. I would advise the reader not to omit, when at the sea-shore, plucking a few handfuls of this weed to drop into his Aquarium. By this means a splendid treat is insured to the captives of the tank. No sooner is it dropped down than numbers of hungry mouths begin snap-snap-snapping, at, a stranger would think, nothing at all. But if a

candle be placed at the edge of the tank, it will soon be seen that the diet is not altogether imaginary. Thousands of minute but lively shrimps, and other objects, may be seen, even with the limited vision of the naked eye, swimming about in all directions, making for the light. If these are examined with a hand-lens, the marvel of the appearance will be not a little increased. The Sea-grass, as its common but expressive name would lead us to suppose, grows in thin wiry fronds, although occasionally I have seen it half an inch broad. A novice is apt to be led away with the idea that it is a juvenile specimen of the broad green *Ulva*.

There is another plant, *Zostera marina*, that in like manner bears the generic name of Sea-grass. It differs from that which we have been describing in this important respect, that it grows with a root "on sandy shallows and banks in the sea. It has very long grass-green leaves, and hence its botanic name is derived from the Greek word *riband*. The French term it *La Zostère*, the Germans *Sea-tang*, and our own coast people commonly call it *Sea-grass*." It is frequently torn up by the force of the waves, and thrown upon the shore, where it soon becomes of a brown or blackish hue. Most of my readers will know it by its commercial name of *Ulva*, or *Alva marina*, it being used extensively in many places for the purpose of filling beds and mattresses in lieu of horse-hair and other expensive material.

I was much pleased on meeting with a passage in

the works of Sir Thomas Browne, in which that great and quaint author alludes to the several varieties of Marine Algæ, such as the Sea-lettuce (*Ulva latissima*), the *Zostera marina*, and others, that grow so prolifically at great depths. Sir Thomas states that the following passage of Holy Writ, "Where waters stood before, dry land appeared without impediment, and out of the violent streams a green field," would seem to imply, that the Israelites passed over a green field at the bottom of the sea. He also adds his belief that the words may be taken literally, instead of metaphorically, since (to use his own words) "there is a part of the Mediterranean Sea called La Prairie, or the Meadowy Sea, from the bottom thereof being so plentifully covered with plants; since vast heaps of weeds are found in the bellies of some whales taken in the Northern Ocean, and at a great distance from the shore, and since the providence of nature hath provided this shelter for minor fishes, both for their spawn and safety of their young ones; and this might be more peculiarly allowed to be spoken of the Red Sea, since the Hebrews named it Suph, or the Weedy Sea."

The next sea-plant in my list is Dulse, Duillisg, or Dillisk (*Rhodymenia palmata*). It belongs to the Rhodosperm, or Red-seeded Algæ. Should the reader ever feel at a loss from not being able to fall in with this sea-weed, he has only to ask the first ragged urchin that comes in his way. Several of these will dodge in amazement about the young

zoologist, attempting to get a peep into his bottles, and exceedingly anxious to ascertain what he can be poking and hunting after. It is probable that some more intelligible idea may be formed of gathering Dulse than of his other pursuits on the sea-shore, for that weed is a favourite esculent with the poor. I have frequently seen many of them make a meal upon Dulse. It is not limited as an article of diet to persons near the shore, but is one of those humble luxuries that are eagerly sought after by the poorer classes in large towns. These either eat it raw, or boil it to make a kind of jelly.

Dulse varies from a rich Burgundy colour to a very deep purple. It affixes itself to the rocks, and oftentimes grows fringe-like upon the thick stems of the great Oar-weed (*L. digitata*).

Growing in even greater profusion than the above is *Chondus-chrispus*, or Irish Moss—an article that, in its dried state, may be had at most grocers' shops. It is sold to make a nutritious jelly for invalids, and, if not so pleasant to look at, is certainly as wholesome as the expensive "shapes" sold by confectioners.

This plant forms a very pretty feature in an Aquarium. As Mr Gosse truly remarks, "it is elegant in form and brilliant in colour; the expanding fan-shaped fronds cut into segments, cut, and cut again, make fine bushy tufts in a deep pool; and every segment of every frond reflects a flush of the most lustrous azure, like that of a tempered sword-blade."

"Dr Greville calls this plant the Proteus of the

Marine Algæ, for it varies so much according to its situation and the measure of light which reaches it,



CHONDUS-CHRISPUS (Irish Moss).

that the young botanist finds it almost impossible to determine to which of the described varieties an indi-

vidual plant belongs, the width of the frond is so different; sometimes it is an inch across its widest part, sometimes not a twelfth part of that width. Then it divides itself into such various shapes; sometimes the segments at the edges being round, in others acute or jagged, or forming long slender points; and if this sea-weed grows in a spot where it is exposed to the influence of fresh water, it alters so much that an ordinary observer of marine plants would think it belonged to a different genus. Then its colour is variable. When growing in a shady pool it is iridescent; while it has been lying, it is bleached perfectly white, when it may be seen in all the intermediate tints between white and dark purple, often tinged, too, with green. Nor is it even constant in its place of growth; for on the very shore where in one spring it lies in great profusion, it is not unlikely that in the following year a few specimens only will be found.” *

Perhaps the most notable of all marine plants for purifying the water of the tank is the blood-coloured Fucus, the scientific name of which is *Delessaria sanguinea*. This Fucus has the good fortune to be a great favourite with the lady collectors. I have seen specimens so cleverly mounted upon card-board, or the pages of an album, that although the fair artist told me she had “collected” them herself, I could not resist slily scraping the edge of the weed with my thumb-nail, to make sure I was not being plea-

* Miss Pratt, “Things of the Sea-coast.”

santly imposed upon ; so much did the whole look like a highly finished painting. It is common only in summer. After rough weather, the beach will be everywhere strewn with its transparent pink leaves, so prettily and so delicately veined.

This beautiful Alga, one writer observes, “so much excels its congeners, that it carries away the palm with no less justice from the vegetables of the ocean, than the rose, the flower of the poets, from its rivals of the garden.”

It reaches a great size in certain localities. Dr Landsborough says—“There is in the possession of my friend Major Martin, of Ardrossan, a magnificent frond of *D. sanguinea*, which Sir W. Hooker said was the largest he had ever seen ; the single frond or leaf is thirteen inches long and eight inches broad.” The average length of this species, however, is about five or six inches.

Most writers divide the sea-weeds into three classes, olive, green, and red. “This division is not an arbitrary, but a natural one, for in a great measure with similarity of colour is connected a similar structure. It is not, however, so invariable as to be a perfect distinction. Among the red sea-weeds we find every shade of purple tint, and of a few of the darker kinds we almost hesitate as to whether we should pronounce them to be red or olive-green ; while exposure to air and light, in some cases, turns a red sea-weed into a dull yellow or dirty white hue, or renders its crimson of a bright scarlet ; and drying in the sun blackens

almost all the olive-green species. Yet, in practically studying sea-weeds, this presents little difficulty, for very generally we find the olive-green plants tough and leathery; the red usually frail and delicate; while the grass-green are always of simplest structure, and of a tint little liable to change. In this almost constancy of colour, the *Algæ* differ greatly from the plants of our upper earth, among which colour is almost useless as a characteristic, giving us scarcely any idea of the nature or properties of the plant, and varying under circumstances of soil or culture. Thus we see the wild hyacinth trembling in the spring-wood, and we call it a blue bell; but we step into the next copsewood, and there we find our favourite woodland flower arrayed in purest white. The 'brown or purple heath' sometimes greets us unexpectedly with snowy bells, and white blossoms sometimes surprise us on the rook where we expect to find the pink flowers of the Robert-leaved cranesbill."*

The olive species of sea-weeds are called *Melanosperms*, or Black-seeded, and many, the most prominent of them, are coarse by comparison with the red or green spored *Algæ*.

On approaching the piers or rocks situated on any part of our sea-coast, we cannot fail to observe them tapestried with the dishevelled locks of the common Bladder-wrack, *Fucus vesiculosus*. This is the commonest of our sea-weeds, and one that child-

* Miss A. Pratt.

ren are so fond of treading upon, and cracking under their feet. The noise they make is occasioned by the explosion of the oval bladders that swell at intervals upon each frond.

Another plant, *Fucus nodosus*, is sometimes mistaken for the above, it also having oval bladders, which serve to buoy up the plant amidst the waves. But the distinction between the two is easily made, by remembering that those of the latter are longer and tougher, and will not break easily; although, when thrown into the fire, they produce a loud report. These bladders are sometimes made into whistles by the juveniles, who, in consequence, have a great penchant for the knobbed or knotted wrack, as it is commonly called.

This *Fucus* may be easily distinguished from the common Bladder-wrack by the absence of a mid-rib. I have a specimen before me that has a beautiful appearance imparted to it by the thick bushy tufts of *Polysiphonia fastigiata*, that grows parasitically upon it. This little plant has a pleasing effect, when its hair-like filaments of deep purple colour are spread upon white paper or card-board.

Confined by the same string that binds the *Nodosus*, and many other weeds that lie on my table, I may mention the *Fucus serratus*, another of the Melanosperms. It has no vesicles upon its surface, but it has something which is far more wonderful and pretty.

Its fronds are shaggy with the *Sertularia pumila*,

the Sea-oak Coralline, and at the same time profusely studded with patches of most beautiful silver lace-work, *Flustra membranacea* (another species of zoophyte). The movements of the marvellous creatures that occupy these cells, can only be seen and appreciated by aid of the microscope, under which instrument, says Dr Johnston, "when the polypes are all protruded, they form a beautiful object from their numbers, their delicacy, and the regularity of their disposition, and the vivacity of their motions, now expanding their tentacular into a beautiful campanulate figure, now contracting the circle, and ever and anon retreating within the shelter of their cells." Dr Landsborough having carefully examined a specimen, reckoned that on every square inch of the web of the silvery lace, as every cell was inhabited by a living polype, there existed above two millions of industrious, and, doubtless, happy inmates, so that a single colony, on a submarine island, of a foot in length, is almost equal in number to the population of Scotland.

But a common hand-lens is quite sufficiently powerful for viewing the singular little mollusc (*Spirorbis*) that ornaments each frond, making it appear at a short distance as if a number of chalk beads had been newly gummed and sprinkled thereon.

The shell of this animal is quite flat on one side, and curled like a ram's horn. From the thickest end we see protruded several exquisite feathers and a small stopper, much in the same style as the Sabella.

This *Fucus*, whose edges are serrated or notched like a saw, is called in Scotland Black-wrack, or Prickly-tang. It is extensively employed on the sea-coast as a manure. "In Norway, it is used as food for cattle, mixed with meal. The Dutch employ it to cover their crabs and lobsters, and keep them alive and moist, preferring it to any other, because it is destitute of that mucus which causes them to ferment and putrify."

There is one other sea-weed that I must not forget to mention, viz., *Laminaria digitata*. It is variously termed Sea-girdle, Sea-hanger, Tangle, Sea-wand, and Five-fingered Oar-weed. "It is called *Laminaria* on account of the thin flat plates or laminæ of the frond, and *digitata* or fingered, because the frond is split into segments, like the fingers of a hand." It has a woody stem, measuring sometimes one inch to one and a-half inches in diameter, and from two to six feet in length. Dr Landsborough, in his admirable "History of Sea-weeds," a book which none of my readers should be without, says:—

"But of what use is this great *Algæ*? Can it be eaten? We have never tasted it; but the young stalks and leaves are eaten along with Dulse; and old Gerard tells us, that when well boiled, and eaten with butter, pepper, and vinegar, it makes good food. Can the woody stems be turned to good account? To very good account; though we cannot rank high in the list of useful purposes an amusing one mentioned by Dr Neill, that of making knife handles—'A pretty thick

stem is selected, and cut into pieces about four inches long. Into these are stuck blades of knives, such as gardeners use for pruning and grafting; as the stem dries, it contracts and hardens, closely and firmly embracing the hilt of the blade. In the course of some months, the handles become quite firm, and very hard and shrivelled, so that when tipped with metal they are hardly to be distinguished from hart's horn.' Neither do we envy the inhabitants of Orkney, Shetland, and the Channel Islands, the use of the plant as fuel. Having abundance of good pit coal at hand, we are very thankful that we need not have recourse to tangle. Were it converted into peat, we should not be unwilling to use it; and we have seen it thus metamorphosed, but on too small a scale to be useful. This was among sandhills on the coast of Ayrshire, where it had been drifted a considerable way inland by some unusually high tide; and having been deeply covered with driven sand, it had lain, it may be, for ages, and had become a layer of peat about two inches thick, in which the stout tubular rind of the tangle stem, in a compressed state, was quite distinguishable.

“But far from unimportant are the purposes to which it has been put in the formation of kelp, to which the stems, and indeed the whole of this plant, greatly contribute. Who would have thought that burned sea-weed would ever have been found useful in the manufacture of such a substance as glass? And yet, till lately, the materials out of which the best window-glass was formed, were two parts of kelp

and one of white sand. The kelp was substituted for the 'fossil alkali,' which, according to a probable account, was accidentally found to contribute to the formation of glass. According to Pliny, 'a merchant vessel, loaded with nitre or fossil alkali, having been driven ashore on the coast of Palestine, near the river Bolas, the crew went in search of provisions, and accidentally supported the kettles on which they dressed them upon pieces of the fossil alkali. The river sand above which this operation was performed was vitrified by its union with the alkali, and thus produced glass. The important hint, thus accidentally obtained, was soon adopted, and the art of making glass was gradually improved. Though kelp, till lately, was chiefly employed in Britain in the manufacture of soap and glass, it is now principally manufactured for the iodine it contains, and no sea-weed is so rich in iodine as this great tangle, especially its woody stems.' "

As I have already stated, two or three of the red and green Algæ are all that are necessary for purifying the water in an Aquarium. There are, however, several others of each class, which, when introduced judiciously, and watched with care, and rejected when they begin to fade or die, look very graceful and elegant. Many of the latter sort are seen to the best advantage when made to jut out from the crevices of rocks, or anchored close to the sides of the glass—such as the common red Coralline, *Corallina officinalis*, the *Ptilota plumosa*, the rich green feathery

Bryopsis plumosa, and the *Griffithsia setacea*—a pretty plant of pinkish scarlet hue.

These, and many more that I have not space even to enumerate, are to be easily met with at Joppa, and most other sea-side localities.

“ How various the shades of marine vegetation
 Thrown here, the rough flints and sea-pebbles among,
The feather'd conferva, of deepest carnation,
 The dark purple sloke, and the olive sea-thong.”

CHAPTER XI.

ON THE ROCK-POOLS OF JOPPA.

“ Art’s finest pencil could but rudely mock
The rich gray lichens broider’d on a rock;
And those gay watery grots he would explore,
Small excavations on a rocky shore,
That seem like fairy baths, or mimic wells,
Richly emboss’d with choicest weeds and shells,
As if her trinkets Nature chose to hide
Where nought invaded but the flowing tide.”

JANE TAYLOR.

“ In 1762, there was one house, and one only, on the spot where Portobello now stands. It was built by an old sailor who had taken part in the capture of Portobello in America, and he named his house after that town. Circumstances afterwards led to the selection of this neighbourhood as a site for private dwellings for the Edinburgh folk, and a very pretty sea-side town has hence arisen. The Portobello sands furnish a fine spot for sea-bathing, and the town is full of the usual kind of holiday visitors during the bathing season.”—*The Land we Live in.*

PERSONS residing in Edinburgh scarcely require to be informed that the village of Joppa does not possess great attraction for visitors. As a bathing-place, it has been long ago deserted for the more fashionable

suburb of Portobello. There are not wanting, however, persons who prefer the seclusion of the one to the bustle of its more successful rival. The writer of these pages, as an item of the minority, has passed more than one vacation by the more secluded beach; and, of course, as soon as his eyes were in any degree opened to the wonders of the sea-shore, he naturally preferred to prosecute his studies where there was less chance of interruption.

Before he had the good fortune to discover the recommendation these new pursuits conferred upon the place, he would not have hesitated in expressing his decided conviction that Joppa was one of the dullest spots that ever went under the name of a watering-place.

The rocks, to any but the ardent student of zoology, are of the most uninviting character, damp and shaggy, with various fuci, and consequently slippery, suggesting, especially to persons of sensitive toes, anything but pleasant spots for looking across at the Fife shore-coast, or down to the rich shores of East Lothian. Indeed, the most agile walker can hardly advance a step without incurring imminent danger of a slip.

But I had no sooner got acquainted with a little of marine zoology, than Joppa became quite a different place; and I can assure my reader that, under similar circumstances, the most stupid and indifferent spot on the sea-coast will assume an interest superior to that of the most charming scenery. Poor and tame as Joppa is, it possesses, in my eyes, a beauty which

only a very limited number of objects in the imperial city beside it can inspire. These same rocks, objects of my former aversion, are now to me what the stairs of Holyrood are to the antiquarian, the Calton Hill to seekers after fine views, or, to expand the metaphor, each barren crag offers to me what quiet woods full of game, and fields abounding in rare flowers, offer to the sportsman and to the botanist. After a time it became a pleasure, almost bordering upon a passion, to be examining some crystal pool, by whose side

“ Nought was heard
Save the rough cadence of the dashing wave.”

Even the commonest sea-weeds, once that I began to know something of their physiological wonders, assumed an importance they could never otherwise attain. Nor was there wanting, I hope, one of the most salutary results of initiation into any branch of knowledge upon the mind, opening it to a higher conception of the wonders of the universe, and, consequently, of the might and grandeur of that Being from whom all these things are, and by whom all things exist. Never surely shall the immortal lines of the poet be more frequently quoted than by the sea-shore :—

“ These are Thy glorious works, Parent of good,
Almighty! Thine this universal frame,
Thus wondrous fair; Thyself how wondrous then!
Unspeakable, who sitt’st above these heavens
To us invisible, or dimly seen
In these Thy lowest works; yet these declare
Thy goodness beyond thought, and power divine.”

One has only to bend down, and peep into the smallest rock-pool, that mimic ocean at his feet, to behold fresh wonders, to which no pen can ever do sufficient justice. Besides the obvious beauty that results from the mirroring of every passing cloudlet on its face, see the host of *Serpula* plumes that vanish whenever the sky looks frowningly upon them, and again bashfully unveil themselves when all is clear in the deep blue of heaven. Note the pink and purple corallines, and the variegated algæ, that cling around, fixing their stems upon its marge, and bending forward, spread their bannered fronds, like silken streamers. Or, again, keep your eye fixed on this little time-worn cavity. Small and insignificant though it appear to the heedless passer by, it contains a combination of wonders that no mind could more conceive than hands could execute. Well, indeed, may the poet ask,

“ Who can paint
Like nature? Can imagination boast,
Amid its gay creation, hues like hers?
Or can it mix them with that matchless skill
And lose them in each other, as appears
In every bud that blows?”

Yet, withal, how few persons are able to appreciate or to enjoy these treasures that encompass them at every step. It is not enough that such wonders exist, nay, are so prodigally scattered that little trouble and no expense are incurred in observ-

ing them—wonders, the study of which expands the mind, that humble pride.

But the study of marine zoology has another recommendation, that ought not to be omitted. As pursued in aquariums, it is one of the few objects in which invalids can interest themselves, not only with pleasure, but with perfect safety. And even to those whose ailments do not make in-door confinement necessary, but are, nevertheless, unable to take active exercise, the study of marine zoology, at least along the shores of the Frith of Forth, is far from hopelessly difficult. Of the benefit which would accrue to invalids from a knowledge of this fact, I was one summer forcibly reminded on the following account:—

I often passed, along the beach at Portobello, a canopied carriage, wheeled down to the shore, in which a young lady reclined—

“ Watching aye

The foam-wreaths which the faint tide wove below
Upon the spangled sands.”

The fair occupant was evidently suffering from some malady that deprived her of the use of her limbs. Although no symptoms of acute pain were to be seen on her handsome and kindly countenance, none could look unsympathisingly at one so young, bedridden, and incapable of moving about. Everything that the eye of affection could suggest, seemed to be adopted for her comfort. Among the most devoted of her attendants was a little Skye terrier, whose in-

genuity in pleasing his mistress was never idle. He appeared to be continually scampering along the sands and bringing back pebbles in his mouth, which, after dropping on the coverlet, he would shew by his barking, he expected—as plainly as a dumb creature could ask—his mistress to throw the stone into the sea, in order that he might paddle in and fetch it out. She, alas! could only hang down her slender fingers for him to kiss.

The reader will easily understand how natural it was in me to wish that I might have been able to direct the attention of this poor lady to the objects of the sea-shore.

At the risk of being considered impertinent, as some may think, I should offer to have done something of the sort, had she not suddenly ceased to visit her accustomed spot.

I am sure I need not attempt to impress the obvious fact, that to such as are blessed with health and strength, it is much better to occupy their time with zoological research, however humble, than, as many thousands at the sea-side do, saunter listlessly about upon the beach, or yawn over silly novels, or “dip into the sugared slough of sentimental poetry, in comparison with which the old fairy tales were manful and rational,” or spend their time in flimsy chit-chat on the trivial topics of the hour.

CHAPTER XII.

HOW TO "COLLECT," AND STOCK THE "TANK."

" And thus while I wander'd on ocean's bleak shore,
And survey'd its vast surface, and heard its waves roar,
I seem'd wrapt in a dream of romantic delight,
And haunted by Majesty, Glory, and Might."

B. BARTON.

" Thus I found, as I have often done before in my natural history experience, that it is not always the most likely places that yield the richest harvest to the explorer."—P. H. GOSSE.

I do not think I can more fitly conclude this little work than by giving some plain directions regarding the establishment of an Aquarium.

Of course the first thing that is required is the tank. This indispensable requisite can be had, of all sizes, ready made, at many shops, both in London and Edinburgh, and at prices varying from two shillings to ten pounds. The expensive kind are of considerable size, and are either square or oblong in form. Their construction is very peculiar, and unless extremely well made, they are apt to become leaky and get seriously out of order. Indeed, the most care-

fully constructed Aquariums of large dimensions are apt to occasion much trouble, especially if shifted often when full of water.

In addition to several primitive tanks, consisting of a china sugar-basin, two glass tumblers, &c., I have two others, the largest of which measures fifteen inches in diameter by six inches in depth, and cost me just four shillings. It rests on a mahogany base supported by ball feet, and presents, I believe, rather a pleasing effect, standing on a small table near the window.

Some persons object to the circular tank, on the ground that its occupants, when seen from the sides, appear magnified. This fact is rather a recommendation with me, as it presents more distinct views of each movement in the vessel; and whenever I wish to see the objects at their natural size, I can do so by looking in from the top.

On the edge of the tank are placed three corks, notched out to the thickness of the glass; on these there is placed a circular piece of common glass, cut two inches larger than the diameter of the tank. As the corks are about three quarters of an inch above the tank, they allow a current of air to pass over the water, and also prevent, to a certain extent, particles of dust from falling in. On the edge of the moveable lid I paste a stripe of white paper, binding like, which prevents the glass from cutting the hand of any person moving it about.

I employ a glass syringe to aërate the water occa-

sionally (the price of this instrument, I may mention, is ninepence); a camel-hair pencil, an ivory crochet pin, and a bent piece of whalebone, complete the whole machinery of the Aquarium. The cost is so trifling that I am sure the poorest person might manage to procure it. I sincerely hope the time is not far distant when a parlour or drawing-room will not be considered completely furnished unless it contain an ocean in miniature in the shape of a tasteful Aquarium.

Now, supposing the tank to be complete, let me describe how to collect stock for it, as well as the simple equipment that is required. Different writers have different opinions upon this subject. One tells us we must have a "pair of high wading boots;" a second states, among other things, that it is necessary to engage the services of "a strong-backed quarryman, with a strong-backed crowbar." The labours of an individual of this class, who assisted the learned author from whom I quote, are thus chronicled:—

"After five minutes' tugging, propping, slipping, and splashing, the boulder gradually tips over, and we rush greedily to the spoil; a muddy, dripping surface it is," &c.

Very probably so; indeed there cannot be much difficulty in realising this picture to the mind's eye. For my own part, I should decidedly object to make a toil of pleasure, and submit to such slavery. I should also object to the "meet me by moonlight alone" appearance of the respectable individual with

the burglar's walking-stick on his shoulders, as my companion through any sea-side place. I have little doubt that a party so equipped would excite no small surprise at, for instance, Portobello! Depend upon it, Mr Policeman, if he could be found, would get a hint from some lazy promenader to ask us a few questions on our return—perhaps search our basket—perhaps get his fingers nipped for his pains by some irascible crab.

I may here observe that, to country folk in general, a naturalist, ardently pursuing his studies on the sea-shore, is looked upon as a madman. Dr Landsborough narrates an anecdote relative to this subject, in his "Excursions to Arran," with such a rich vein of humour, that I cannot refrain from quoting it entire.

"Meeting a Highlander, who had been angling like himself, the Doctor (Dr Connel) invited him to partake from good cheer which he had brought in his pocket. During the repast the Highlander said to him, 'Ye'll no belang to this place?' 'No,' said Dr Connel, 'I do not.'—'Ye'll be frae Ayrshire or Greenock maybe?' 'No,' was the reply.—'Ye'll be mair to the eastward; frae Edinburgh, or maybe frae Glasgow?' 'Yes,' said the Doctor, 'I generally live in Glasgow.'—'It's a big town Glasgow; I hae been ance there mysel. Ye'll never hae been in this place afore?' 'O yes, I have often been in Arran. I spent some time in it last year.'—'And where are ye staying noo, if ye please?' 'I am staying at ——.'—'I ken the place; ye'll never hae stayed there

afore ?' 'Yes, I stayed there last year also.'—'Save us!' said he, looking aghast, 'ye're no the daft man that was there last year?' 'Yes,' said the Doctor, laughing, 'I am just the daft man.' He looked at him with a very suspicious eye; but as the meat and drink were very good, and very acceptable on so cold a day, he continued to enjoy the repast, convinced that, though the gentleman might be *daft*, he was neither unkind nor *uncannie*."

Dr Landsborough then adds:—

"He is not the only naturalist in the west who has fallen under the suspicion of being rather 'wrong in the mind.' Captain Carmichael, of Appin, being often seen by the country people wandering on the shore, and even wading in the sea, taking up handfuls of trashy sea-weeds, and, after examining them, casting them back into the sea, or, what was worse, carefully securing them in a tin box, as if they had been precious treasures, they came to the conclusion that he was decidedly wrong in the head. However, as he was very kind and peaceful, they regarded him with compassion. A stranger, walking on the shore one day with a person belonging to that neighbourhood, seeing the Captain wading in the sea, with his shoes and stockings in one hand, and some sea-weeds in the other, said to his companion, 'Who is that?' 'Oh,' replied the other, 'that's the Captain. Poor man! He is no himsel; he is far wrang—very far wrang to-day, poor man—for it is full moon!'"

The equipment, to those persons living at the sea-

side, is exceedingly simple—merely a nice brown wicker fancy basket, with a division at each end for two preserving jars or glass bottles, the central space being used for holding the small hammer and chisel, hand-net, weeds, &c. A lady could carry the whole with the greatest ease.

To persons resident, say in Edinburgh or within two or three miles from the “hunting-ground,” as the fancy basket would not be very suitable for a gentleman, I would simply recommend a small leather (carpet ?) bag to be kept for the purpose. It would, of course, have a division in the centre, lengthways. It might be prudent to stow a pair of old shoes in one compartment; and as the sea water is rather injurious to leather, these could be slipped on while at the rocks. In the other division, at each corner, might be placed a glass bottle, while the intervening space might hold a flat strawberry basket, if nothing better offers. The bottles can be used for fish, fine sea-weeds, nudibranchs, &c., and the basket will hold the indispensable hammer and chisel, weeds, univalves, bivalves, actiniæ, &c.

It is seldom that an hour's search at the rocks will not suffice to afford an ample stock of objects, unless one happens to be on the search after curiosities. Should the zoologist have the good fortune to settle upon an interesting spot, then two, or even three hours will seem insufficient.

Having finished your search, you can walk or ride home without attracting more attention than any or-

dinary traveller. Very few, indeed, would have the least idea of the kind of luggage that your carpet bag contained.

Sea water can always be readily enough obtained. A stone jar should be kept for the purpose of holding it. Care must be taken that the jar is perfectly free from any smell, as that of spirits, dirty cork, or the like; any such impurities would instantly spoil the supply. One great point in favour of an Aquarium, and one by no means generally understood, is, that having once filled the tank with the briny fluid, it will last for months, and even years, if proper care be taken, without requiring one particle of sea water to be again added; for as the water evaporates, the salt falls to the bottom, and the deficiency may be supplied with *fresh* water from the cistern or filter. In order to ascertain when the sea water is of the proper density, you require to have a gravity bubble, which can be had for sixpence. This may always be kept in the tank. When "all's well" it sinks to the bottom, and when anything comes amiss it rises to the surface, but falls again quickly upon the introduction of the *fresh* water.

A more simple plan is to mark on the glass the height of the fluid when the tank is first filled; then, as the water sinks, raise it to the original level by means of the fresh water.

The arrangement of the "stock" of an Aquarium is quite a matter of taste; perhaps no two persons adopt precisely the same plan. It may, therefore, be

advisable, as this matter is so arbitrary, for me to state how my own is mapped out, leaving it to my readers to imitate my arrangement or adopt a style of their own as they may think proper.

I always had, until lately, a *penchant* for placing about two inches of sand at the bottom of the tank, from the idea that it would be obliging the Fiddler-crabs and their crustaceous friends. I now find this is quite unnecessary. The crabs can hide under stones if they like, or make themselves at home, and walk about the grounds in a free and easy style. The fact is that, in aërating the water, it frequently stirs up the sand ; and when this is the case, it settles on weeds and other objects, making them look rather unsightly. I therefore now only place a few milk-white pebbles and shells at the base of the vessel ; around the outward edge I dispose the pieces of rock that have the various delicate weeds attached. These, rising up against the sides of the tank, have, to my eye, a charming effect. Sometimes I place in it temporary pieces of rock, and on these I lay two or three mussels. When the latter have moored themselves to the glass by their silken cables, I take away the pieces of rock from below. The animals then live suspended as long as I please. On the pebbles I lay Pholades, in such a position that I can easily watch their movements. In the centre of the Aquarium I have a large oblong piece of sandstone, that projects always two inches above the top of the water, in order that the fishes can get air easily, if required,

or rest themselves if they feel disposed. At the base of this stone are several flat pieces of rock, on which some Daisy-anemones are flowering, with the large Pholas, in his chair of state, poised in the centre. Behind the high rock is a mass of sea-grass and green ulva for my pretty pack of Blennies to hide in or shelter themselves at will. Two Soldier-crabs perambulate here, there, and everywhere, as do several Winkles and Limpets. A fine Trochus, a pearly-white Doris, and a purple-coated Eolis oftentimes affix themselves to the centre rock, and add to its picturesqueness and beauty; while several minute Star-fish "drag their slow length along" over the sides of the tank. Some Serpula, one Crassicornis, and one Mesembryanthemum complete my stock, which, I am proud to say, are all in a healthy condition. The water is clear as crystal; and I feel satisfied in my own mind that, although so many little creatures are in captivity, they are as comfortable and happy in this mimic pool as in their native haunts by the sea-shore.

APPENDIX.

APPENDIX.

NOTE I.—(Page 10.)

“In our previous cursory reference to the wonderful transformations undergone by the Barnacle tribe, the reader would understand that these assertions rest upon the evidence of modern naturalists.”—In fact, principally upon the evidence of Mr J. V. Thompson, of Cork,* who states, that he watched one of these singular little creatures through the wonderful changes of its existence. We may say, with Mr Kirby, in his “Bridgewater Treatise” on the History, Habits, and Instincts of Animals, that the thing is not impossible, for with God all things are possible, but it appears in the highest degree improbable. “That a locomotive animal, gifted with eyes and legs, should, by an extraordinary metamorphosis, in its perfect state, become a Barnacle, without head, eyes, or locomotive organs, can never be admitted, till confirmed by

* Mr Spence Bate has also endeavoured to corroborate Mr Thompson’s theory. See “Mag. Nat. His.,” 1851, xiii. 8.

repeated experiments of the most able and practised zoologists, so as to place the matter beyond dispute." I by no means, however, mean to assert, that Mr Thompson did not think he saw what he has stated in both cases to take place; but he was probably deceived by appearances, in some such way as he states *Slaber* to have been.

A single fact by Poli is sufficient to overturn this whole hypothesis. This illustrious conchologist relates that he had an opportunity of examining the immense fecundity of the Sessile Barnacles. "In the beginning of June he found innumerable aggregations of them covering certain boats that had long been stationary, which, when closely examined, were so minute, that single shells were not bigger than the point of a needle; and that from that time they grew very rapidly, and arrived at their full size in October." These very minute ones must have been hatched from the eggs, and not produced from larvæ.

NOTE II.—(Page 44.)

"*Then there are gnarled trunks of what were once noble forest trees, still clinging with stony roots to their native soil.*"—There are few subjects more deeply interesting than those that bear upon the encroachments of the mighty sea upon the land. For the information

of the youthful reader, I may be permitted to quote a few passages which relate to this topic.

Plato and Pliny, among ancient authors, give many wonderful statements of the sea swallowing up certain lands and cities, as well as lofty mountains, in various parts of Europe. And the old historian Camden observes :—

“ We may gather from the words of Giraldus, that Cape St David’s once extended further into the sea, and that the form of the promontory has been altered. When Henry the Second was in Ireland, by reason of an extraordinary violence of storms, the sandy shores of this coast were laid bare, and the face of the land appeared, which had been covered for many ages, *also the trunks of trees which had been cut down, standing in the midst of the sea, with the strokes of the axe as fresh as if they had been cut yesterday*, with very black earth, and several old blocks like ebony; so that it did not appear like the sea-shore, but rather resembled a grove—by a miraculous metamorphosis, perhaps, ever since the time of the deluge, or long after, at least very anciently—cut down and consumed, and swallowed up by degrees, by the violence of the sea continually encroaching upon and washing off the land.”

Scotland has suffered severely from this dreadful enemy. Even so late as 1769, an estate near Forres, worth at one time three hundred pounds per annum, was entirely overwhelmed and destroyed. So rapid were the encroachments of the sand, which came upon

it in sweeping heaps, that an apple-tree which grew there was, in the course of the season, so buried, as that nothing but the summit remained visible.

In Wales, a long range of coast was at one time overwhelmed by the sea; so sudden was the calamity, and so unexpected, that it is stated, at the time of its occurrence, there were in one lordly mansion many persons assembled at a great feast given by its owner. "When the guests were carousing and calling for more wine, the harper was suddenly struck with amazement as his spirit foresaw the coming evil; and the servant, who had gone down to the cellar for wine, rushed wildly into the hall, crying out, 'The tide! the tide!' The harper and the servant alone had time to escape, and found safety in the mountains; all the rest were swallowed up—lands, flocks, and houses—by the impetuous torrent." *

NOTE III.—(Page 45.)

"See! in a short time I have succeeded in capturing the very thing I want—a fine little specimen of the Medusa, or, as it is more familiarly known, a Sea-blubber, &c.—These animals, when caught, look like small bubbles in the net. So transparent are they, that the uninitiated zoologist is apt to think it is the water dripping through the muslin that he sees, in-

* *Vide* Appendix to P. H. Gosse's "Tenby."

stead of the little *Acalephs*. They must not be touched with the hand, or the pressure of the fingers is sure to injure their delicate form; but “when the net is taken out of the water, it must be carefully reversed, and its contents gently emptied into a basin or glass jar filled with clear salt water. It is best to plunge the net beneath the surface when being emptied, as thus the *Medusæ* are enabled to detach themselves from the threads and swim away without injury. When the net is taken out of the water, they appear like little adhering shapeless masses of clear jelly, and exhibit no traces of their elegant form and ornaments. When in the jar or basin, they are often, on account of their extreme transparency, very difficult to distinguish; but by placing the vessel in the sun, or beside a strong artificial light, we see their shadows floating over the sides and bottom of the basin, like the shadows of flitting clouds on a landscape.” *

* Forbes.

GLOSSARY

OF

SCIENTIFIC TERMS,

Extracted principally from Professor Owen's learned Work, entitled "Lectures on the Comparative Anatomy and Physiology of the Invertebrate Animals."

Acalepha (Gr. *akalephe*, a nettle)—The class of radiated animals with soft skins which have the power of stinging like a nettle.

Actinia (Gr. *aktin*, a ray)—The genus of Polypes which have many arms, radiating from around the mouth.

Annellid—The Anglicised singular of *Annellata*.

Annellata (Lat. *annellus*, a little ring)—The worms in which the body seems to be composed of a succession of little rings, characterised by their red blood.

Animalcules—Those extremely small animals which are invisible to the naked eye.

Antenna (from the Latin for yard-arm)—Applied to the jointed feelers or horns upon the head of insects and crustacea, and sometimes to the analogous parts, which are not jointed, in worms and other animals.

Arborescent (Lat. *arbor*, a tree)—Branched like a tree.

Balanoids (Gr. *balanos*, an acorn)—A family of Sessile-cirripeds, the shells of which are commonly called *acorn-shells*.

Bivalve—When a shell consists of two parts, closing like a double door. The mollusca so protected are commonly called bivalves, as the Mussel.

Brachyura (Gr. *brachus*, short; *oura*, tail)—The tribe of crustacea with short tails, as the Crabs.

Byssus (from the Greek word signifying the silky filaments which project from the bivalve called Pinna)
—Applied to the analogous parts in other molluscs.

Carapace—The upper shell of the Crab or Tortoise.

Carnivorous (Lat. *caro*, flesh; *voro*, I devour)—The animals which feed on flesh.

Cephalopoda (Gr. *kephali*; *poda*, feet)—The class of molluscous animals in which long prehensile processes or feet project from the head.

Cilia (Lat. *cilium*, an eyelash)—The microscopic hair-like bodies which cause, by their vibratile action, currents in the contiguous fluid, or a motion of the body to which they are attached.

Cirri (Lat. *cirrus*, a curl)—The curled filamentary appendages, as at the feet of the Barnacles.

Cirripeds, or *Cirripectia* (Lat. *cirrus*, a curl; *pes*, a foot)
—A class of articulate animals having curled jointed feet; sometimes written Cirrhipedia and Cirrhopoda.

Conchifera (Lat. *concha*, a shell; *fero*, I bear)—Shellfish; usually restricted to those with bivalve shells.

Coriaceous (Lat. *corium*, hide)—When the part has the texture of a tough skin.

Cornea (Lat. *corneus*, horny)—The transparent horny membrane in front of the eye.

Crustacea (Lat. *crusta*, a crust)—The class of articulate animals with a hard skin or crust, which they cast periodically.

Digitate (Lat. *digitus*, a finger)—When a part supports processes like fingers.

Entomostraca (Gr. *entoma*, insects; *ostrakon*, a shell)—The order of small Crustaceans, many of which are inclosed in an integument like a bivalve shell.

Exuvium (from the Latin signifying the skin of a serpent)—The skin which is shed in moulting.

Fucivorus (Lat. *fucus*, sea-weed; and *voro*, I devour)—Animals which subsist on sea-weed.

Frond (Lat. *frons*, a leaf)—A term applied to that part of flowerless plants resembling true leaves.

Gasteropoda (Gr. *gaster*, stomach; *pons*, a foot)—That class of molluscous animals which have the locomotive organ attached to the under part of the body.

Hinge—That part of a shell at which the valves cohere.

Ligament—A membrane close by the hinge which connects the valves.

Mantle—The external soft, contractile skin of the mollusca, which covers the viscera and a great part of the body like a cloak.

Medusæ—A genus or family of soft radiated animals, or Acalephæ, so called because their organs of motion and prehension are spread out like the snaky hair of the fabulous Medusa.

Multivalve (Lat. *multus*, many; *valvæ*, folding doors)—Shells composed of many pieces or valves, as the Chiton.

Nudibranchiate (Lat. *nudus*, naked; *branchiæ*, gills)—An order of Gasteropods in which the gills are exposed.

Operculum (from the Latin for lid)—Applied to the horny or shelly plate which closes certain univalve shells; also to the covering of the gills in fish, and to the lids of certain eggs.

Pectinated (Lat. *pecten*, a comb)—Toothed like a comb.

Serrated (Lat. *serra*, a saw)—Toothed like a saw.

Sessile—Attached by a base.

Silicious (Lat. *silex*, flint)—Flinty.

Tuberculate—Warty, or covered with small, rounded knobs.

Testacea (Lat. *testa*, a shell)—Molluscs with a shelly covering, as the Oyster, Whelk, &c.

Univalve (Lat. *unus*, one; *valvæ*, doors)—A shell composed of one calcareous piece, as the Periwinkle.

Umbones—The base of the shell, about the hinge.

Whorl—The spiral turn of a shell.

Zoology—From the Greek word signifying to speak of animals.

Zoophyte (Gr. *zoon*, animal; *phyton*, plant)—The lowest primary division of the animal kingdom, which includes many animals that are fixed to the ground, and have the form of plants.

THE END.

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